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NBI Technical Reports: Wetlands and Biodiversity Series

Nile Basin Wetlands Biodiversity Assessment Report

WRM/WBS-2022-07

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Document Sheet

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The purpose of the technical report series is to support informed stakeholder dialogue and decision making in order to achieve sustainable socio-economic development through equitable utilization of, and benefit from, the shared Nile Basin water resources.

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Authors	James MacKenzie, Margaret Harrison, Georg Petersen
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Contents

List of Tables

List of Figures

List of acronyms

CBA:	Critical Biodiversity Area
CBD:	Convention on Biological Diversity
DWS:	Department of Water and Sanitation (South Africa)
EI:	Ecological Importance
EIS:	Ecological Importance and Sensitivity
ES:	Ecological Sensitivity
IBA:	Important Birding Area
NBI	Nile Basin Initiative
PES:	Present Ecological Status
RAMSAR	The Convention on Wetlands, called the Ramsar Convention, is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources.

GLOSSARY OF TERMS

Definition of species descriptors to be employed in this study:

1) Umbrella species are species selected for making conservation-related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat. E.g. Papyrus
2) A flagship species is a species selected to act as an ambassador, icon or symbol for a defined habitat, issue, campaign or environmental cause. E.g. Shoebill. In conservation biology, a flagship species is a species chosen to raise support for biodiversity conservation in a given place or social context. ... Species selected since the idea was developed in 1980s include widely recognised and charismatic species like the black rhinoceros, the Bengal tiger, and the Asian elephant.
3) A keystone species is a plant or animal that plays a unique and crucial role in the way an ecosystem functions. Without keystone species, the ecosystem would be dramatically different or cease to exist altogether. Some keystone species, such as the wolf, are also apex predators. E.g. Papyrus
4) Indicator species, an organism that serves as a measure of the environmental conditions that exist in a given locale. For example, greasewood indicates saline soil; mosses often indicate acid soil. A bioindicator is any species (an indicator species) or group of species (indicator guild) whose function, population, or status can reveal the qualitative/quantitative status of the environment.
5) Limnophilic species, pertains mostly to fish, but comprises organisms which prefer to live in lakes, ponds, marshes, pools or other slow moving, still or stagnant water.
6) Potamodromous (of a migratory fish) fishes that migrate within fresh water only.

Wetlands International (https://www.wetlands.org):
"Wetlands occur where water meets land. They include mangroves, peatlands and marshes, rivers and lakes, deltas, floodplains and flooded forests, rice-fields, and even coral reefs. Wetlands exist in every country and in every climatic zone, from the polar regions to the tropics, and from high altitudes to dry regions."

Marshes:
Marshes are defined as wetlands frequently or continually inundated with water, characterized by emergent soft-stemmed vegetation adapted to saturated soil conditions. There are many different kinds of marshes, ranging from the prairie potholes to the Everglades, coastal to inland, freshwater to saltwater. All types receive most of their water from surface water, and many marshes are also fed by groundwater. Nutrients are plentiful and the pH is usually neutral leading to an abundance of plant and animal life.

Swamps:
A swamp is any wetland dominated by woody plants. There are many different kinds of swamps, ranging from the forested Red Maple, (Acer rubrum), swamps of the Northeast to the extensive bottomland hardwood forests found along the sluggish rivers of the Southeast. Swamps are characterized by saturated soils during the growing season and standing water during certain times of the year. The highly organic soils of swamps form a thick, black, nutrient-rich environment for the growth of water-tolerant trees such as Cypress (Taxodium spp.), Atlantic White Cedar

(Chamaecyparis thyoides), and Tupelo (Nyssa aquatica). Some swamps are dominated by shrubs, such as Buttonbush or Smooth Alder. Plants, birds, fish, and invertebrates such as freshwater shrimp, crayfish, and clams require the habitats provided by swamps. Many rare species, such as the endangered American Crocodile, depend on these ecosystems as well. Swamps may be divided into two major classes, depending on the type of vegetation present: shrub swamps and forested swamps.

Phreatophyte:
Plants with temporary or permanent access to groundwater.

Palustrine:
Vegetation frequenting a group of wetlands traditionally called marshes, swamps, bogs, fens and vleis.

Lacustrine:
An area of permanent water with little flow i.e. relatively shallow lake

Riverine:
All wetlands contained within a channel which contains flowing water, either periodically or continuously

DISCLAIMER

This report was based on the author's best scientific and professional knowledge and information available at the time of writing. Although MacKenzie Ecological & Developments Services (MEDS) has tried to ensure that all information contained within this report is accurate, MEDS does not warrant or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of the information presented in this report.

Executive summary

'Biodiversity' refers to the diversity of species of plants and animals and their habitats on Earth. The term 'biodiversity' only became a common phrase in the late 1980s (Wilson 1989), and includes all genes, species, and ecosystems, and the ecological processes of which they are a part (Gaston 1996). Species are often taken as the unit upon which assessments of the status of biodiversity are made and have come to be used as the common currency to express biodiversity.

The Convention on Biological Diversity (CBD) and the Ramsar Convention jointly compiled guidelines for the rapid ecological assessment of biodiversity of, among others, inland water ecosystems, highlighting the need for the promotion and guidance of such studies (CBD & RAMSAR, 2006). The guidelines are designed as a suite of optional tools to assist in rapid inventories and assessment and monitoring of biological diversity. The guidelines focus largely on species (assessments of taxa) but also include some tools relevant for assessment of habitats.

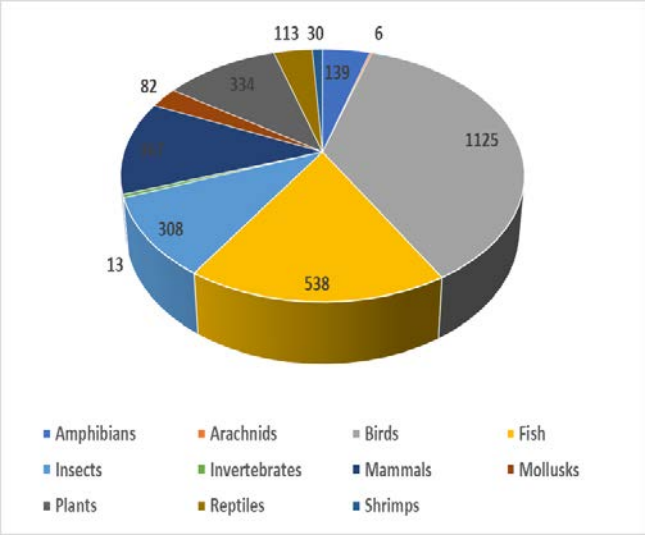
Their overall conceptual framework for rapid assessment highlights an iterative process whereby the definition of purpose and the availability of existing information and data determines which tools and kinds of assessments are pursued. Intermediate steps include the review of existing knowledge (including traditional and local knowledge) and data, the identification of knowledge / data gaps, the study design and implementation and analysis and report production. Different purposes or objectives for information require different assessments. Options include baseline inventory assessments, species-specific assessments, change assessments, indicator assessments and resource assessments, each type with different output styles and formats. The basis of these guidelines underpins this study, but the outcomes were largely dependent of the quantity and quality of existing data.

The biodiversity assessment of the wetlands with transboundary importance in the Nile Basin was essentially an inventory and analysis of existing data, in all forms available, and broadly consisted of the following components:

1. Assessment of species / taxa diversity and richness

Over 3000 taxa occur in the Nile Basin that occur in or utilise wetlands. These have been listed and assigned to each of the wetlands within which they occur (Appendix 1). Proportions of the total have been derived that enable comparative (between wetland) taxon richness (Table 1).

Table 1. Summary of numbers of taxa in the Nile Basin



- 3079 taxa were noted to occur within or utilize wetlands in the Nile basin
- Birds and fish represent the largest contribution, followed by mammals, plants and insects, highlighting the knowledge gap that exists for [aquatic] invertebrates
- Generally, species diversity increases in a South to North direction, along a rainfall gradient, but lake habitats seem to result in marked increased diversity due to the contribution by fish species (Figure 3-2)
- The Nile Delta, Dinder, Lake Tana and the Machar Marshes have Moderate species richness; the Sudd, Bahr el Ghazal, Lake Kyoga, Kagera and Mara have High species richness; and the Semliki, Lake Victoria and Sio Nzoia Yala Nyando complex have Very

	High species richness (Table 3-2 – Note that this refers to relative species richness expressed as a proportion of the total species within the basin).

2. Threatened species (Table 2)

The species listed above have also been summarised in terms of their IUCN threat status and apportioned per wetland and per taxon group (e.g. plants, birds, mammals, fish etc.; Figures 3.4 to 3.16). The table below shows their status and arrangement between different wetlands. Clearly, wetlands associated with lake ecosystems have higher numbers of threatened taxa due to the high numbers of threatened fish species that inhabit such ecosystems.

Table 2. Summary of threatened species for each wetland group

Wetland:	Critically Endangered	Endangered	Near Threatened	Vulnerable	Conservation Dependent
Bahr el Ghazal	3	5	13	11	5
Baro/Akobo Sobat Wetlands (Machar Marshes)	1	5	17	13	7
Dinder	4	4	16	13	5
Kagera	3	5	19	10	4
Lake Kyoga	3	7	18	9	3
Lake Tana	3	4	15	17	
Lake Victoria	58	20	37	49	5
Mara	47	8	16	31	2
Nile Delta	5	7	19	6	
Semliki	5	13	32	18	4
Sio Nzoia Yala Nyando	50	10	20	36	1
Sudd	4	5	17	15	6

3. Notable species

Assignment of species as flagship, umbrella and keystone, indicator, important and endemic was done and associated with each wetland / wetland complex (refer to relevant sections in the main report for definitions which are important when interpreting these data). A total of 61 flagship species were recognised within the basin (refer to Appendix 3 for full list; Table 3) e.g. Shoebill, Black Crowned Crane, Papyrus Yellow Warbler, White-eared Kob, Nile Lechwe, Sitatunga, Victoria Tilapia and Nile Softshell Turtle. Keystone and umbrella species are frequently the same, and usually wetlands indicators as well. The number of umbrella and keystone species within each wetland is summarised in Table 3-4 and listed in Appendix 4. The following table shows a summary between wetlands:

Table 3. Number of Keystone species for each wetland group

Wetland	Number of Keystone & Umbrella Species
Bahr el Ghazal	9
Baro/Akobo Sobat Wetlands (Machar Marshes)	11
Dinder	11
Kagera	11
Lake Kyoga	11
Lake Tana	7
Lake Victoria	18
Mara	10
Nile Delta	6
Semliki	13
Sio Nzoia Yala Nyando	12
Sudd	15

4. Indicator species (Table 4)

An organism that serves as a measure of the environmental conditions that exist in a given locale, within the basin are summarised in Table 3-5 for each wetland and listed in full in Appendix 5.
The following table shows the indicators recognised in this study:

Table 4. Number of indicator species per taxon group for different wetland groups

	Indicators per Taxon Group							
Wetlands	**Amphibians**	**Birds**	**Fish**	**Insects**	**Mammals**	**Plants**	**Reptiles**	**Total**
Bahr el Ghazal	4	72	2		15	26	2	121
Baro/Akobo Sobat Wetlands (Machar Marshes)	4	79	3		9	31	4	130
Dinder	2	86	3		7	28	4	130
Kagera	7	79	6	1	7	40	1	141
Lake Kyoga	7	82	6	2	7	32	1	137
Lake Tana	2	84	1		3	28	2	120
Lake Victoria	14	90	6	2	12	50	2	176
Mara	7	75	6		6	33	1	128
Nile Delta		78	3		1	25	1	108
Semliki	11	87	7	1	10	41	2	159
Sio Nzoia Yala Nyando	11	72	5	1	6	39		134
Sudd	5	76	3		10	40	4	138
Total	**74**	**960**	**51**	**7**	**93**	**413**	**24**	**1622**

Species can be important for different reasons. This study recognised species that are important because they are alien species that have a significant negative impact on the integrity and diversity of wetlands in the basin. These are summarised in Table 3-6. Note that the Nile Perch is indigenous to most portions of the Nile River, but was introduced to Lake Victoria in the 1950's where it is seen and functions as an invasive alien species. Recognised, important alien species include Floating Fern, Water Hyacinth, Red River Gum, Nile Perch, Water Lettuce and Guppy.

Endemism (Table 5) is the ecological state of a species being unique to a defined zone, or habitat type; organisms that are indigenous to a place are not endemic to it if they are also found elsewhere. This table summarises the levels of endemism between wetlands in the Nile basin.

Table 5. Endemic taxa per wetland group

Wetland / Wetland Complex	Region of Endemism								Total	Rank
	General	Country / Region	Lake George & the ...	Mediterranean Region	Central Africa	Eastern Africa	Northeastern Africa	Northern Africa		
Bahr el Ghazal	2	1			6				9	0.04
Baro/Akobo Sobat Wetlands (Machar Marshes)	8					1	6		15	0.07
Dinder	1	1				1	8		11	0.05
Kagera	1					32			33	0.15
Lake Kyoga						39			39	0.17
Lake Tana	6					1	19		26	0.12
Lake Victoria	2					223	1		226	1.00
Mara						195			195	0.86
Nile Delta	3	1		2				3	9	0.04
Semliki			1		25	43			69	0.31
Sio Nzoia Yala Nyando						203			203	0.90
Sudd	11	1			6	1	3		22	0.10

5. Wetland integrity and habitat diversity (Table 6)

Table 6. Wetland Integrity Scores

Wetland	Integrity Scores 2018
Bahr_el_Ghazal	0.79
Dinder_Floodplain	0.50
Kagera_Swamps	0.96
Kyoga_Kwania_Swamp_Complex	0.93
Lake_Edward	0.98
Lake_George	0.93
Lake_Tana	0.97
Machar_Marshes	0.78
Mara_Wetland	0.76
Nyando	0.65
Nzoia_River	0.76
Semliki_Valley_Wetlands	0.67
Sio_Siteko	0.40
Sudd	0.87
The_Nile_Delta	0.35
Yala_Swamp	0.78

Different wetland habitats have been listed and described and linked to land use data. The land use data have also been used to derive wetland integrity scores and associated ecological (management) categories for each delineated wetland. Scores and ecological categories lend themselves well to scenario assessment as well as long-term monitoring (management application). The within-wetland integrity scores calculated for the wetlands in this study are shown in Table 4-3 (a full list of all wetlands; summary data shown here), over time, spanning 1985, 2005 and 2018. For ease of view they have been colour-coded according to each assigned ecological category. Many of the wetlands have high integrity scores that equate to desirable ecological categories (B/C or higher), but several wetlands have low integrity scores that are considered ecologically unacceptable (D/E or below).

6. Important bird areas and migration routes

The BirdLife International database was used to align Important Birding Areas (IBAs) to respective wetlands of interest (Table 7). Names and detailed descriptions of these IBAs is outlined in Appendix 7 (Fishpool & Evans, 2001; BirdLife International, 2019) and summarised in Table 5-1. A ranking (measure of importance) of wetlands was derived using both the numbers of IBAs associated with wetlands as well as the area covered by all respective IBAs. In terms of the numbers of IBAs associated with wetlands, the Lake Victoria wetlands ranked the highest, but Semliki, Kagera, the Sio Nzoia Yala Nyando complex and the Nile Delta were also high (Table 5-1). Lake Tana, the Sudd and the Mara wetlands ranked the lowest since these wetlands harbour but a single IBA. The ranking of wetlands is different if the area of IBAs is used rather than the number of IBAs. In this case the Sudd ranks the highest, but the Baro/Akobo Sobat Wetlands (Machar Marshes) is also high.

Table 7. Important Birding Areas (number and aerial extent) for each wetland group

Wetland	IBA Count	Rank (Count)	IBA Area (Ha)	Rank (Area)
Nile Delta	5	0.50	203889	0.04
Dinder wetlands	2	0.20	2090000	0.38
Lake Tana wetlands	1	0.10	400000	0.07
Baro/Akobo Sobat Wetlands (Machar Marshes)	3	0.30	4544500	0.83
Sudd (Bahr el Jebel)	1	0.10	5500000	1.00
Bahr el Ghazal wetlands	0	0.00	0	0.00
Lake Kyoga wetlands	3	0.30	98100	0.02
Semliki wetlands incl. Lake Albert / George / Edward	7	0.70	1655100	0.30
Lake Victoria wetlands	10	1.00	537763	0.10
Kagera wetlands	6	0.60	303230	0.06
Mara wetlands	1	0.10	50000	0.01
Sio Nzoia Yala Nyando wetlands	5	0.50	9100	0.00

7. Niche descriptions and links to flow dependency

Hydraulic and hydrological niche descriptions have been tabulated for important indicator species / guilds, which tie in well with some of the land use categories. These descriptors include flooding frequency, duration, timing, water depth preferences and seasonality, as well as base flow levels. Perturbation beyond these preferences is seen to illicit a response which can be qualified and related to changes in various metrics of biodiversity such as wetland integrity and ecological category. For example, the dominant habitat types and ecotypes are outlined in Table 6-2 for the Sudd. Only the types that are flow dependent and sensitive to changes in flow are pertinent here. This includes four main habitats: open water vegetation (aquatic and fringe), Papyrus marsh, Reed beds (*Phragmites*) and river flooded grassland (Toich). These can be discerned in satellite data and therefore relate directly to the land use data. Each habitat type, in turn is represented by a dominant indicator or suite of indicators, each with a set of hydraulic and hydrological niche preferences. These links between habitats, land use and indicators are shown in Table 6-5 and the respective niche preferences in Table 6-6. These “niche preference rules” can be used to code changes in habitats, and therefore species, to perturbations in hydrology.

8. Applying the outcomes to the Sudd as a case study

Outcomes of the biodiversity assessment were summarised for the Sudd and then used to derive a measure of Ecological Importance and Sensitivity (EIS). EIS considered both biotic and abiotic factors and the resultant EIS was HIGH (Table 8). The management translation of a HIGH EIS is that the Sudd is considered to be unique on a national scale due to its biodiversity (habitat diversity, species diversity, unique species, rare and endangered species, flow dependency and role in migratory processes, including IBAs).

Table 8. Ecological Importance and Sensitivity of the Sudd

DETERMINANTS / METRICS	PRESENT RATING (0-4)	CONF	COMMENTS
Wetland Biota			
Rare & endangered	3	3	44 threatened taxa, ranked 5th between wetlands, only lower than wetlands with lake environments
Unique (endemic, isolated, etc.)	2.5	3	22 endemic taxa but not ranked high between wetlands
Intolerant (flow & flow related water quality)	3	2.5	More than 50% of taxa dependent on permanent water
Species/taxon richness	3	3.5	695 taxa or 23% of taxa in basin
Wetland Habitats			
Diversity of types	3	3	15 of a possible 19 wetlands ecotypes present in the Sudd
Refugia	2.5	2	Vast slow water zones and backwaters for birds, fish, invertebrates and amphibians
Sensitivity to flow changes	1.5	2.5	more of the wetland is flood dependent than the permanent swamps, although there are no steep gradients
Sensitivity to flow related water quality changes	1	1.5	Low confidence but it is assumed to be low due to the magnitude of the system
Migration route/corridor (instream & riparian)	4	3.5	19 migratory bird species and tiang and white-eared kob migrations – has high basin ranking
Importance of conservation & natural areas	4	4	Contains National Park, and vastly untouched with high ecological category and integrity
MEDIAN	3		
EIS EVALUATION	HIGH		

Land use data and habitat and biodiversity information was used to assess the overall health of the Sudd wetland complex using WetHealth Level 1. Land use cover categories used / derived in WetHealth included Infrastructure (1% of wetland area), Deep flooding by dams (0%), Shallow flooding by dams (0%), Crop lands (1%), Commercial plantations (0%), Annual pastures (10%), Perennial pastures (2%), Dense Alien vegetation patches (1%), Settlements (1%), Gardens (0%), Areas of sediment deposition/ infilling & excavation (0%), Eroded areas (1%), Old / abandoned lands (0%) and Overgrazing (15%). Results indicate that the hydrology is in a category C, the geomorphology a category A and the vegetation a category B. Overall the ecological category for the Sudd is a B (score of 1.41). This equates to a system that is largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. The main impacts are grazing, agriculture and settlements, although these occupy or disturb a small proportion of the vast wetland.

Foreword

Wetlands have been recognized worldwide for both their importance and sensitivity. They are important to both humans and the natural world within which humans live. They provide critical ecological services to humanity, notably flood attenuation, baseflow conservation, agricultural production and their high contribution to biodiversity. This report focusses on the biodiversity, not only of wetlands in general, but more specifically of those wetlands that overlap national boundaries, or those that have transboundary significance. Biodiversity is a modern concept and takes into consideration both taxonomic (species / taxa) and biophysical (habitats) diversity. Habitats, in turn, are largely derived from the dynamic outcomes of ecosystem drivers, notably hydrology, geomorphology and biotic engineers (keystone species for example). This report deals with the quantification and qualification of wetland biodiversity within the greater context of wetland management. Recognizing the value of biodiversity is paramount to successful and effective management of wetlands, but such recognition needs to be more, needs quantification, to facilitate the decision-making process. The work hereunder endevours to address this need so as to rationalize and optimize wise water resource management within the Nile Basin. As important as they are, wetlands have also been recognized as sensitive ecosystems. Since their internal functioning is highly dynamic and flow dependent, they are easily abused and deterioration of ecological health is not only common worldwide, but also occurs rapidly and with ease. Since prevention of deterioration is a by far better option than wetland restoration, it stands to reason that proactive and well-informed management is desirable. As such the knowledge and quantification of wetland integrity, a surrogate for, and directly related to health, is vital for the facilitation of management. This report outlines an approach to define and assess wetland integrity using available data, and takes the first step towards its quantification. The outputs, if used correctly, should make a notable contribution towards strategic adaptive management of wetlands within the Nile River Basin.

Informational and pictorial summaries representing a stylised overview of generic wetland types, represented by examples within the basin are shown in Annexure 9. Typical marsh / floodplain wetlands are represented by the Sudd, fringe wetlands associated with deep water lakes are represented by Sio Siteko and confined rivers with seasonal floodplains by the Dinder floodplains.

1 Introduction

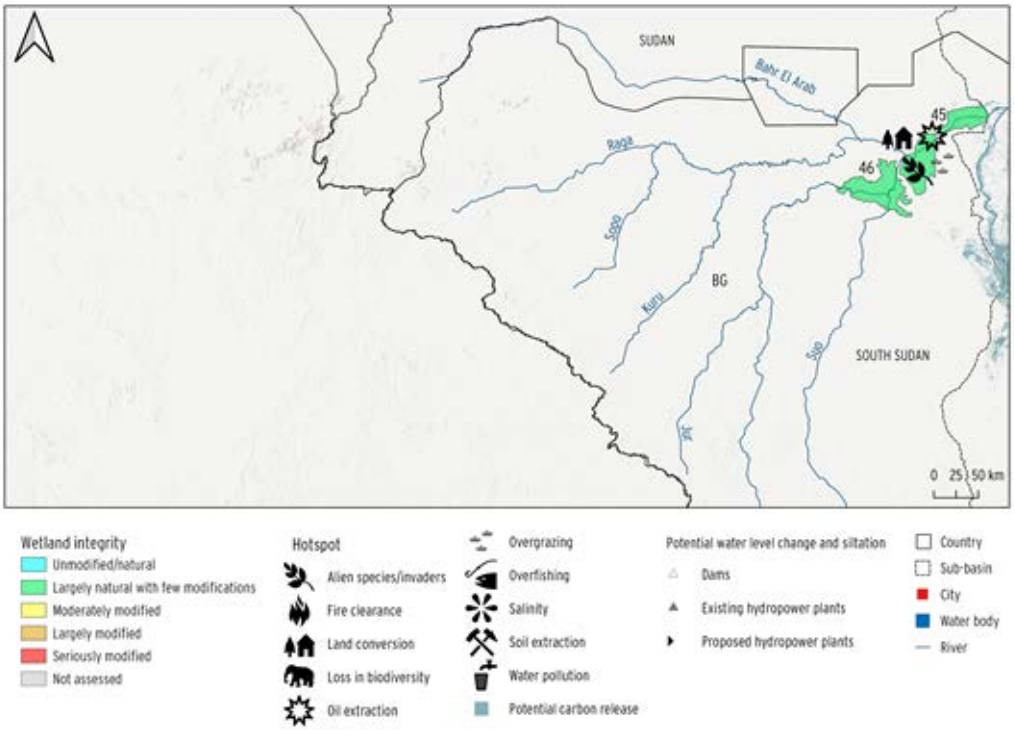
1.1 Short Summary

Over 3000 taxa occur in the Nile Basin that occur in or utilise wetlands. These have been listed and assigned to each of the wetlands within which they occur (Appendix 1). Birds and fish represent the largest contribution, followed by mammals, plants and insects, highlighting the knowledge gap that exists for [aquatic] invertebrates. Generally, species diversity increases in a South to North direction, along a rainfall gradient, but lake habitats seem to result in marked increased diversity due to the contribution by fish species. The Nile Delta, Dinder, Lake Tana and the Machar Marshes have Moderate species richness; the Sudd, Bahr el Ghazal, Lake Kyoga, Kagera and Mara have High species richness; and the Semliki, Lake Victoria and Sio Nzoia Yala Nyando complex have Very High species richness. The main threats to and impacts on Biodiversity of the wetland groups are:

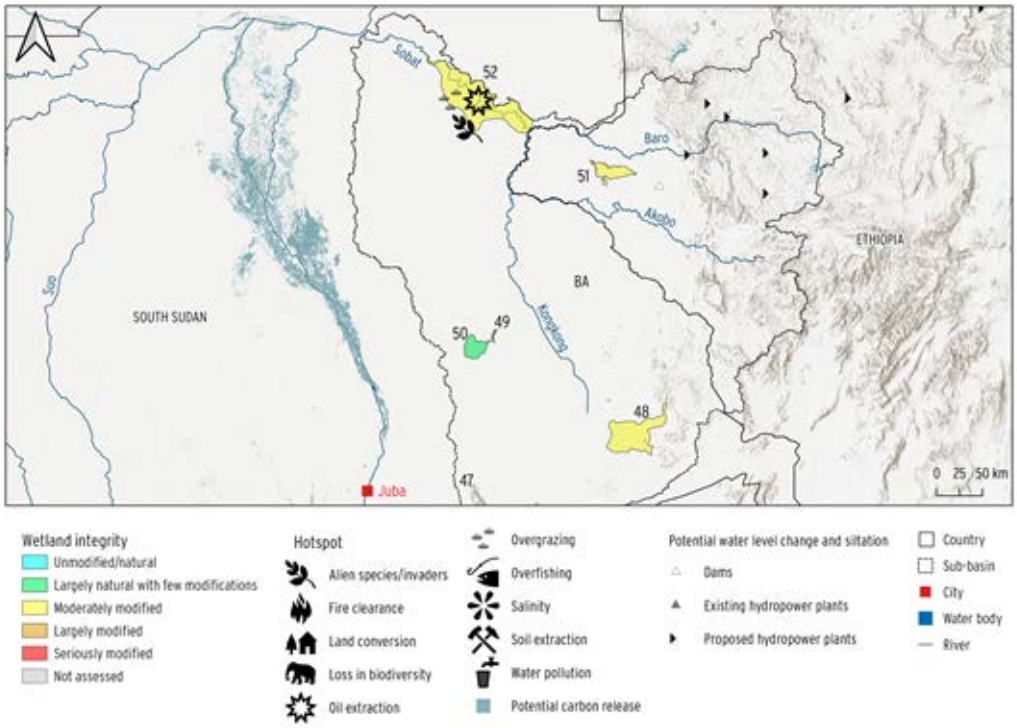
- Lake Victoria: Changes to the integrity of the wetland through draining, agriculture, hydropower and introducing of the Nile Perch hinders the wetland from coping with the subsequent pollution and climate change. Over exploitation and habitat degradation by alien plants and fish are main impacts.
- Mara: Overgrazing and changes to the flow of the river upstream impacts on Mara and on downstream users.
- Kagera: Agriculture has the most important impact on the biodiversity through loss of habitat and pollution of the water and the removal of vegetation.
- Sio: Changes in the flow and volume of the water through hydropower, canal construction and over abstraction has the greatest impact on biodiversity.
- Nzoia: Changes in water quality through hydropower and pollution from draining for agriculture, mining and chemical pollution from agriculture, industrial waste and mining.
- Yala: Greatest impact on biodiversity is the change in water quality through hydropower, mining, rice farming and diversion of the Yala River.
- Nyando: Greatest impact on biodiversity is the change in water quality and flow through farming, industrial and sewage discharge and Owen Falls Dam.
- Sudd: Greatest impact on biodiversity is the change in water quantity and flow by anthropogenic activities, oil exploration, *Eichhornia crassipes* and the proposed completion of the Jonglei Canal.
- Semliki: Greatest impact on biodiversity is the change in land use surrounding the wetland resulting in water pollution from agro-chemicals, industrialization and urbanization and increase in siltation of Lake Albert.
- Kyoga: The greatest impact on biodiversity is through the decrease in water quality and quantity caused by an increase in anthropogenic activities and the lake's clay has high retention properties thereby retaining water pollution.
- Bahr el Ghazal: Anthropogenic activities such as fishing and agriculture increases the effects of climate change on the wetland thus impacting on biodiversity.
- Machar Marshes: Should any water from this system be stored or extracted upstream of the Machar Marshes, the area of the seasonally flooded marshes will be reduced and impact on livestock and wildlife. It is one of the most important wetlands in the basin.
- Lake Tana: Anthropogenic activities and hydropower have the greatest impact on biodiversity.
- Dinder: Reduction of quality of wildlife forage through anthropogenic activities, especially overgrazing, reduces the biodiversity and functioning of the Dinder ecosystem.
- Nile Delta: Construction of Aswan High Dam prevents annual flooding and migration of fish and disappearance of *Cyperus papyrus* swamps.

The following maps (taken from the Atlas WP1) highlight summaries of wetland integrity and major impacts for different wetland groups in different sub-basins:

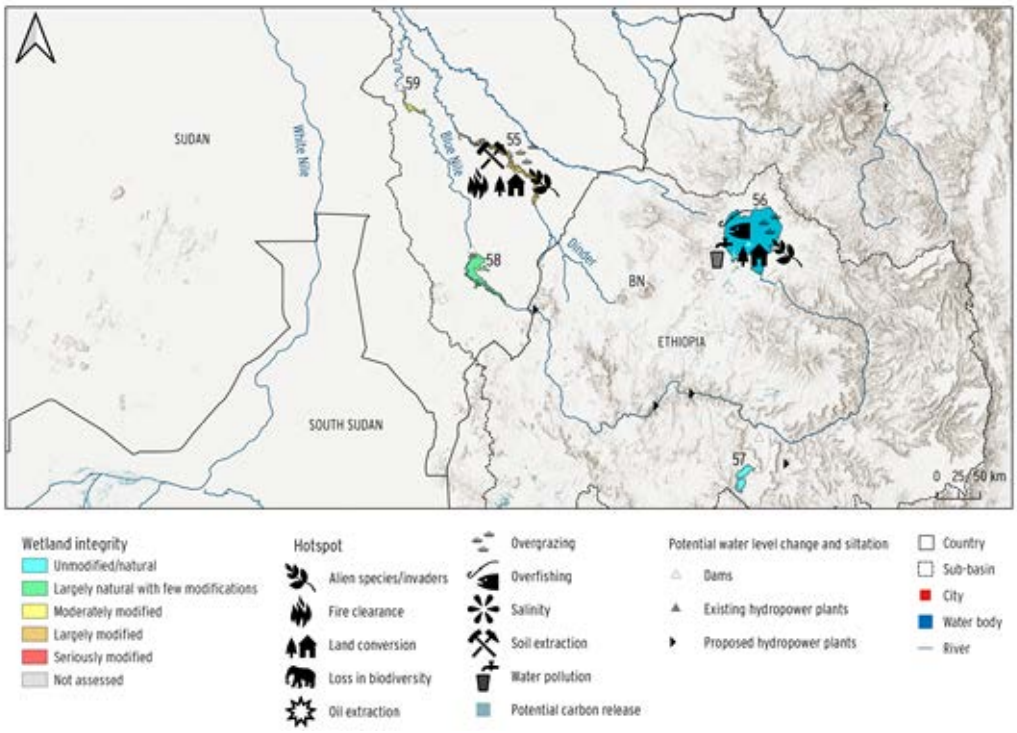
Bahr el Ghazal Sub-basin



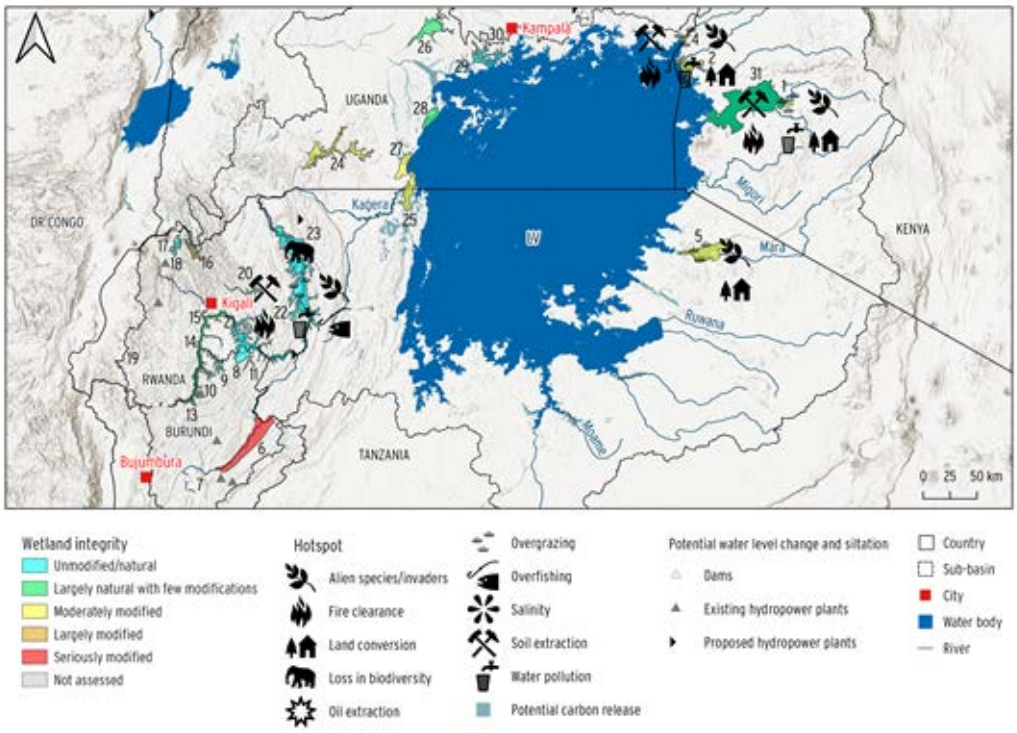
Baro Akobo Sobat Sub-basin



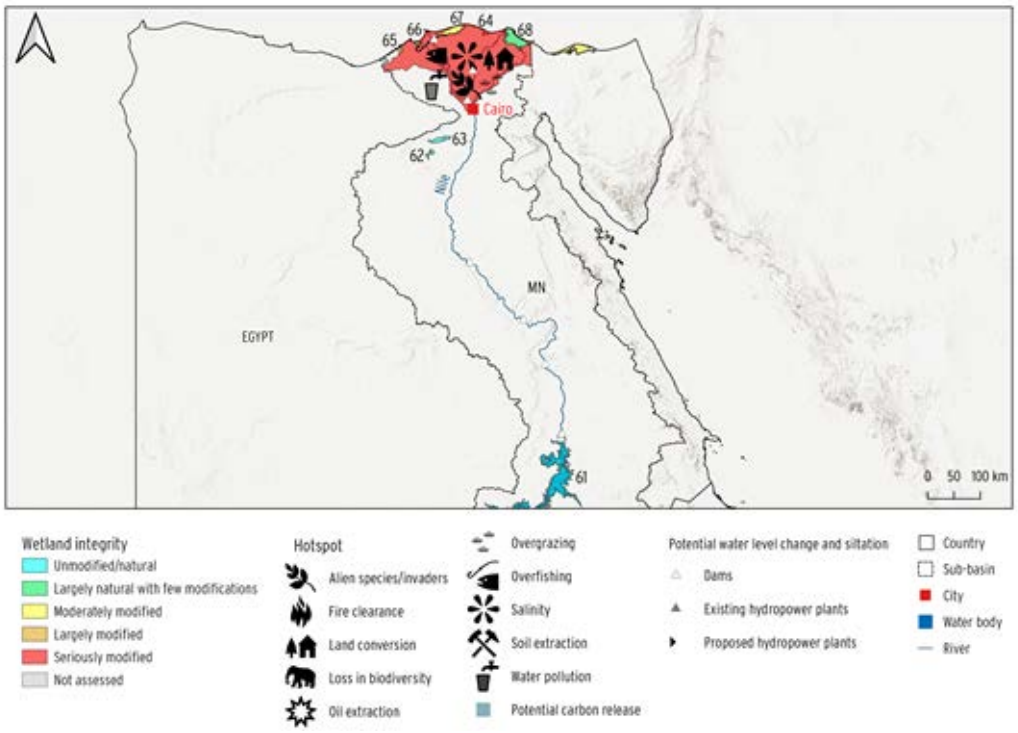
Blue Nile Sub-basin



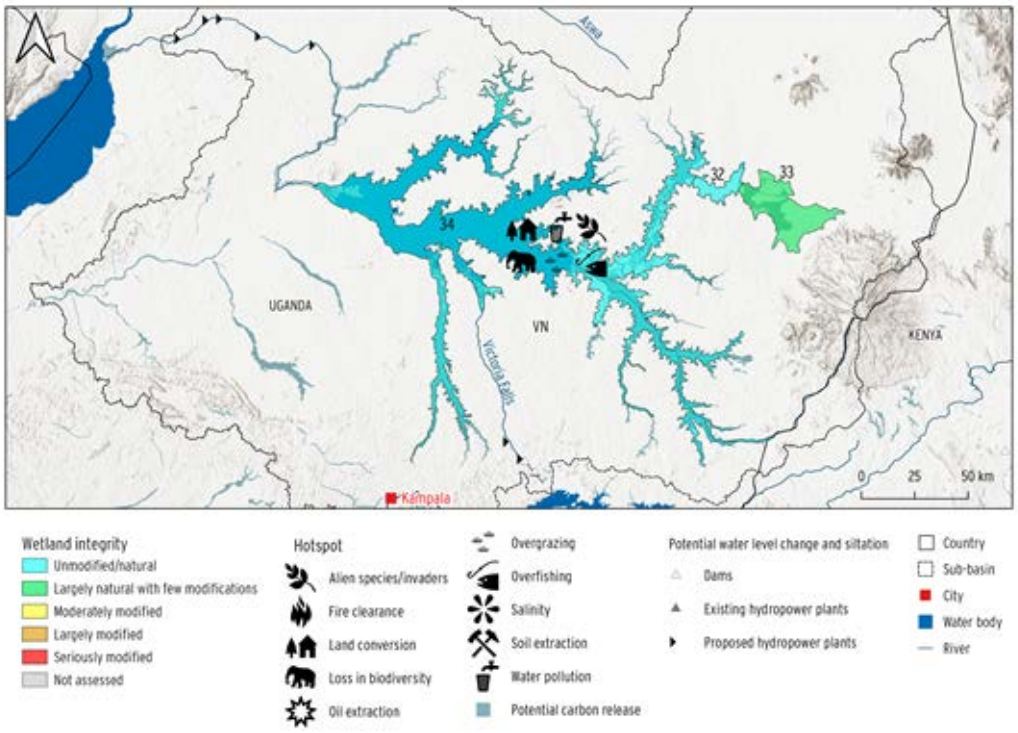
Lake Victoria Sub-basin



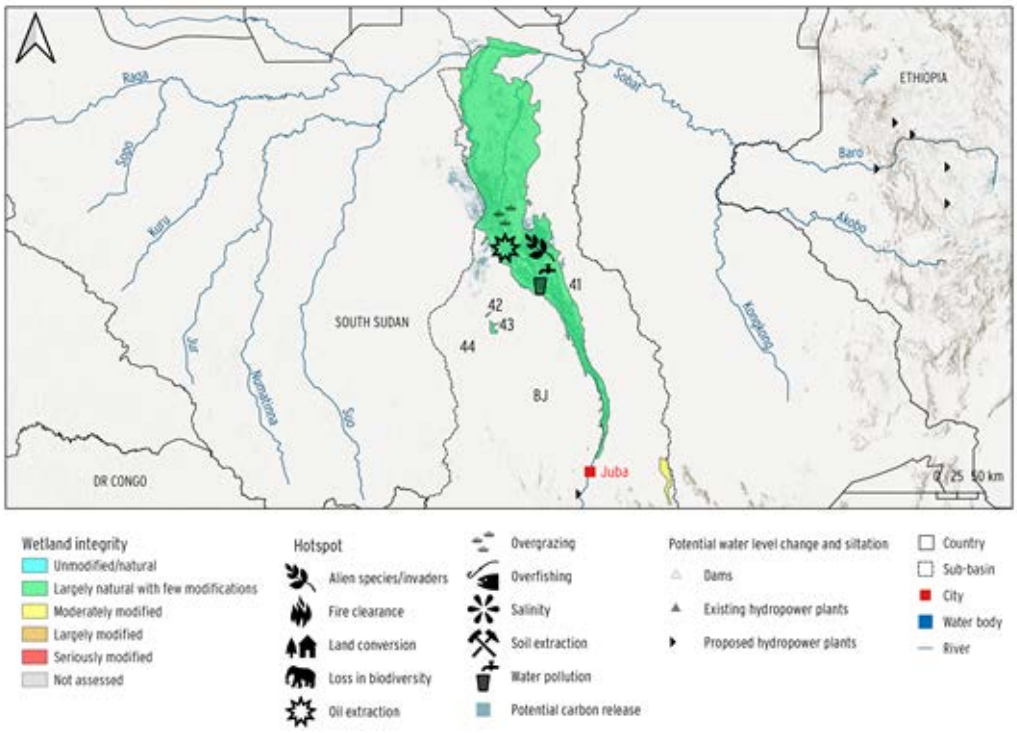
Main Nile Sub-basin (Delta)



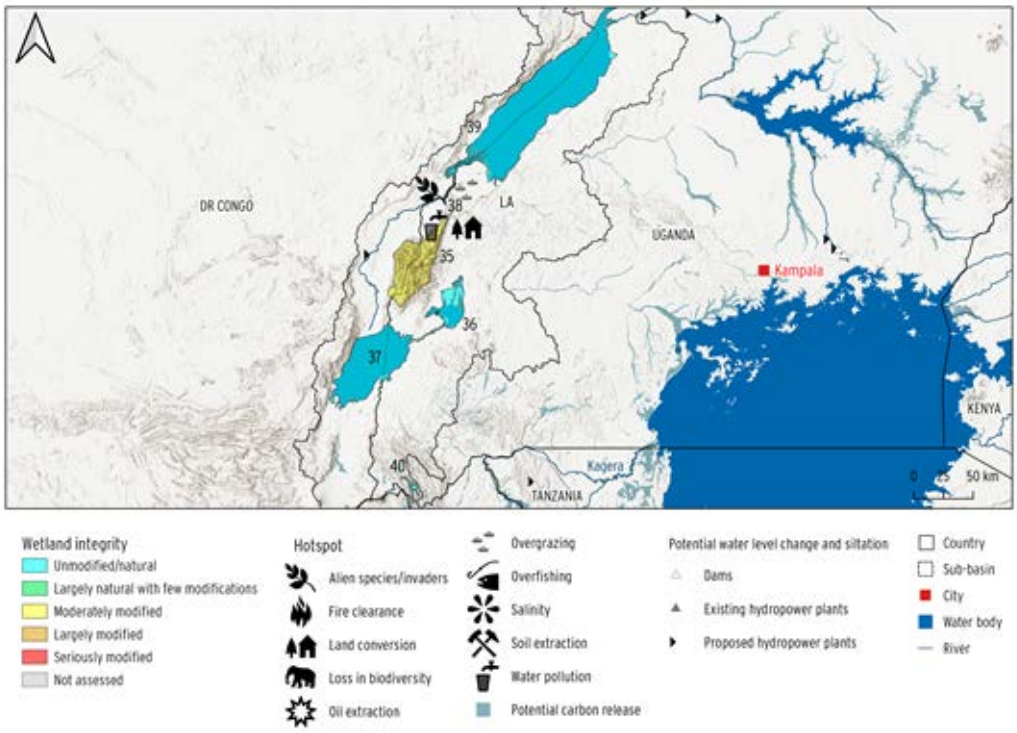
Victoria Nile Sub-basin



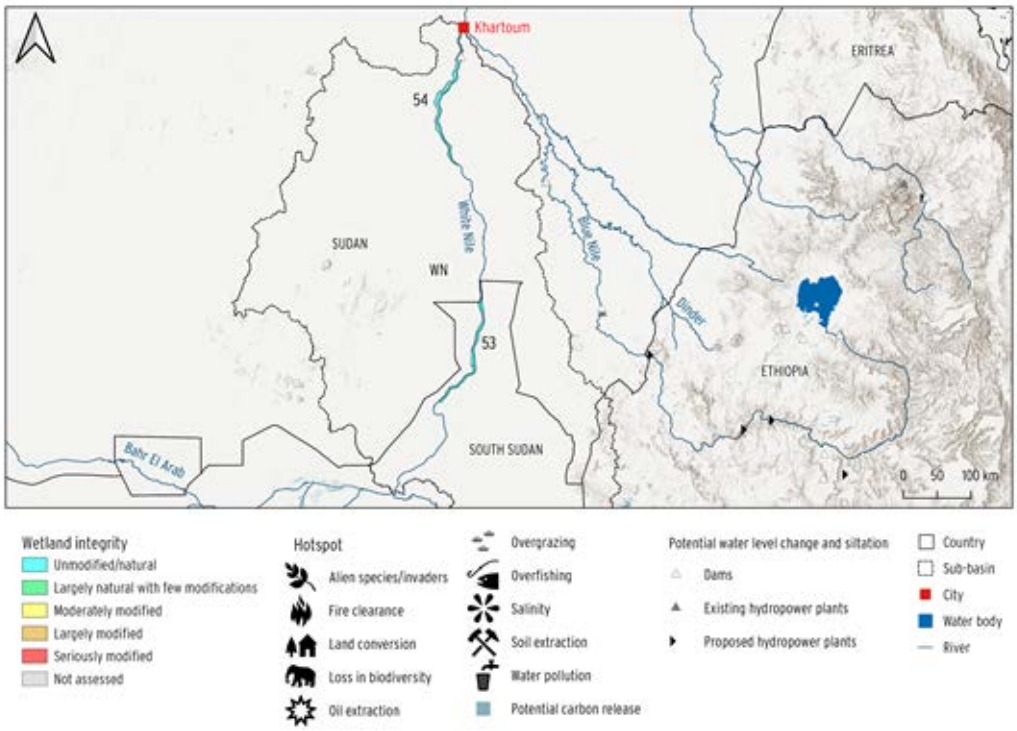
Bahr el Jebel Sub-basin



Lake Albert Sub-basin



White Nile Sub-basin



1.2 Background

'Biodiversity' refers to the diversity of species of plants and animals and their habitats on Earth. The term 'biodiversity' only became a common phrase in the late 1980s (Wilson 1989), and includes all genes, species, and ecosystems, and the ecological processes of which they are a part (Gaston 1996). Species are often taken as the unit upon which assessments of the status of biodiversity are made and have come to be used as the common currency to express biodiversity. This is mainly because data for species status (such as the IUCN Red List of Threatened Species) and distribution tend to be more readily available on the global scale, than for ecosystem properties such as habitat, geomorphic or hydrological diversity.

About 10% of the Nile Basin is comprised of lakes and wetlands and these play a vital role in the hydrology of the Nile River system (Wetlands of the Nile Basin). Storage of water in lakes and wetlands is of particular importance in the White Nile Basin, where evapotranspiration from wetlands is also a major component of the catchment water budget (Sutcliffe and Parks, 1999). Besides being the longest river worldwide, the Nile River Basin has many unique features such as the Sudd wetland, the largest freshwater wetland in its basin, Lake Victoria, which is the second largest natural open surface water body, 17 Ramsar wetlands and a vast diversity of fauna and flora.

The Convention on Biological Diversity (CBD) and the Ramsar Convention jointly compiled guidelines for the rapid ecological assessment of biodiversity of, among others, inland water ecosystems, highlighting the need for the promotion and guidance of such studies (CBD & RAMSAR, 2006). The guidelines are designed as a suite of optional tools to assist in rapid inventories and assessment and monitoring of biological diversity. The guidelines focus largely on species (assessments of taxa) but also include some tools relevant for assessment of habitats. While assessments of biota and habitats is a large focus, it is also highlighted that assessments should include identifying (and possibly quantifying) threat categories to biodiversity. The underlying theme however promotes the idea that biodiversity has value and therefore an accounting of its state / status is vital to its required management.

Their overall conceptual framework for rapid assessment highlights an iterative process whereby the definition of purpose and the availability of existing information and data determines which tools and kinds of assessments are pursued. Intermediate steps include the review of existing knowledge (including traditional and local knowledge) and data, the identification of knowledge / data gaps, the study design and implementation and analysis and report production. Different purposes or objectives for information require different assessments. Options include baseline inventory assessments, species-specific assessments, change assessments, indicator assessments and resource assessments, each type with different output styles and formats. The basis of these guidelines underpin this study, but the outcomes are largely dependent of the quantity and quality of existing data. It should be noted that there are no prescriptive methods for a biodiversity assessment per se, hence the existence of guidelines. This is mainly because there are so many factors that affect what is done, such as budget, timeframe, scale, available data, and objective and use of the assessment. The guidelines essentially facilitate navigation through these factors, depending on the exact circumstances, to give the best possible outcome and to guide toward what is possible.

1.3 Objectives of the Study

Main:
Develop a simple assessment approach for the biodiversity value of wetlands, relate biodiversity value to the biophysical (hydrology [environmental flows], geomorphology) and social (ecosystem services) characteristics of landscapes.

Secondary:
To do so for a case study of the Sudd

Components of the Assessment:
The biodiversity assessment is to be developed for the current situation based on the following approaches:

- A “habitat / land cover” typology / condition (should include list of wetland and wetland habitat types)
- Important bird areas / water bird areas
- Major wildlife migrations mapped in relation to wetlands (not only birds)
- Distribution of species, highlighting umbrella / flagship / keystone species such as shoebill, sitatunga
- Threatened / sensitive species and ecosystems

Context:
Key context is development in order to assist scenario evaluation:

- The concept of biodiversity assessment – in particular umbrella / indicator species and their linkage to habitat types and again back to key state variables of wetlands (hydrology, landuse), is to be developed for indicators that can contribute to management scenario evaluation (both flow and non-flow related scenarios).

The following key documentation shall guide the methodology employed for this study:

- CBD and RAMSAR guidelines for the rapid ecological assessment of biodiversity in inland water, coastal and marine areas (CBD / RAMSAR, 2006).
- Ramsar Convention Secretariat, 2010. Wetland Inventory.

Deliverables:
Key deliverables are:

- Technical Paper: Biodiversity assessment methodology and baseline for Nile Wetlands
- Inventory: Baseline biodiversity assessment to be integrated into the inventory / atlas

Deliverables packaged as follows:

1. Species Lists: for each wetland / wetland group, and to include distribution maps and photos where possible as well as other info (see below for detail)

2. Key migration routes: not only birds, of migration in relation to wetlands
3. Wetland Health / Integrity: Index – internal wetland integrity, habitat proportions and ecological categories

1.4 Applicable Legislatio

1.4.1 International Policies and Agreements

Convention on Biological Diversity

The Convention on Biological Diversity defines biodiversity as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems. The definition of this Convention caters for wetland ecosystems, because most of these (wetlands ecosystems) are aquatic and serve as habitat of several biological species. In addition, the Convention has 20 Aichi Targets, which are time-bound and measurable being the key elements of the Strategic Plan for Biodiversity 2011-2020 (https://www.cbd.int/sp/). Seven of the Aichi targets are relevant to wetlands ecosystems as follows:

Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably. Wetlands are essential in providing water-related ecosystem services, such as clean drinking water, water for agriculture and regulating water quantity (e.g. flood regulation). Wetlands also play a role in erosion control and sediment transport, contribute to land formation and resilience to storms, and provide many water-dependent services, such as agricultural production, fisheries and tourism.

Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems. The full value of water and wetlands needs to be recognised and integrated into decision-making in order to meet our future social, economic and environmental needs.

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced. Wetlands continue to be lost at an alarming rate. Estimates suggest that 64% have disappeared since 1900 and 87% lost since 1700. Main causes include changes in land use, water diversion (dams, dikes and canalization), infrastructure development, air and water pollution, and excess nutrients.

Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity. Wetlands act as filters and help reduce the nutrient load from fertilizer use and urban waste water and help prevent eutrophication in lakes and streams.

Target 11: By 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained. Species dependent on both freshwater and coastal wetland are declining faster than those reliant on other ecosystem types, including many migratory species.

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Wetlands provide multiple ecosystem services supporting water security and offer a wide range of benefits and values to society and the economy. Values of both coastal and inland wetland ecosystem services are typically higher than for other ecosystem types. Promoting restoration of degraded wetlands to improve water and food security can be a critical means of ensuring the provision of public goods and addressing poverty (as the rural poor are generally more directly reliant on ecosystem services).The promotion of restoration of degraded wetlands has been highlighted by Sustainable Development Goal 6,target 6.6 which states that by 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

1.5 Specialist Details

James MacKenzie is the sole and founding member of MacKenzie Ecological & Development Services CC, and has been a freelance ecologist since 2003 specialising in the assessments and management of wetlands and riparian zones throughout southern Africa. He completed his BSc Hons in 1993 (*cum laude*), started his MSc the next year and converted this into a PhD on the regeneration of riparian vegetation along the rivers within Kruger National Park. After 8 years of study the PhD was put into abeyance and has unfortunately not been completed. James has 18 years of experience in riparian and wetland specialist work including vegetation surveys, assessment of present ecological status, wetland and riparian zone delineation, wetland offset calculations and strategies, determination of Environmental Flow Requirements, assessment of Ecological Importance and Sensitivity, assessment of Habitat Integrity, the development of monitoring protocols and programmes, the development and definition of management goals for Strategic Adaptive Management (SAM) (Ecological Specifications and Thresholds of Probable Concern), the development of VEGRAI (Riparian Vegetation Response Assessment Index), and presentation of VEGRAI training in many fora, and vast participation in EIA's with focus on the riparian and / or wetland component of specialist aquatic surveys. The geographical span of his work includes the following countries / regions: South Africa, Lesotho, Swaziland, Namibia. Botswana, Mozambique, Malawi, Zambia, Kenya, Tanzania, Inner Niger Delta (mostly Mali), Mekong (including Thailand, Loas, Vietnam, Cambodia), and the Nile River Basin (10 African countries).

Margaret Harrison has a Bachelor's degree in Parks and Recreation Management from Stellenbosch University (1999), followed by a Masters in Environmental Management from the University of the North-West (Potchefstroom) (2006). At Potchefstroom her dissertation contrasted the EIA processes of South Africa with that of Malawi. She is interested in all things environmental, and was the first environmental consultant in Gauteng to achieve Green Building certification. She has a passion for organic food, sustainability, renewable energy sources and recycling. Previous work experience includes environmental work for Africon, Galago Environmental and numerous editing of reports amongst others, environmental health impact assessments; environmental impact assessments and occupational therapy assessment reports.

1.6 Limitations and Gaps

Limitations to this study include:

- Desktop study - the work is intended to be a desk/literature review task on the reputable sources of information. No field work or site visits were conducted in this study. All information and data which underpin the tasks outlined herein were based upon existing literature, information and data sets. Since datasets such as land use categories, which have been derived using satellite data, have direct implication to the calculation of wetland integrity and health, their quality may be a limitation that is easy rectified by ground truthing, which if conducted would be a notably improvement to the outcomes of this and other work packages.
- The vast scale of the assessment is a limitation to the amount of detail that can be included and assessed.
- Access to existing data that is not online – it has not always been possible to access existing data that is not in the public domain, such information would enhance the current study.

Assumptions underlying this study:

- The reviewed literature and datasets are reputable.

- The land use categories derived from satellite data are accurate enough to be meaningful and useful for the calculation of wetland integrity and health.

Gaps identified in this study:

- Online datasets were used to “collect” species and taxa distribution and status information. It is evident that some datasets are underrepresented or mostly absent, notably aquatic invertebrates, molluscs and shrimps, while others such as birds and plants are well represented.
- Autecological data and understanding of many wetland specific species are unknown. Directed autecological studies would enhance the outcomes. Such direction could be taken from the keystone, umbrella and indicator lists of species hereinunder.
- Land use data can be improved in resolution so that wetland integrity scores are more realistic. This can be done by manually checking satellite data or by filed verification.

2 Study Area

2.1 Scale of the Assessment

The scale of the assessment was limited to wetlands that have transboundary importance within the entire Nile River Basin. Several rounds of discussions produced a list of 12 wetlands, or wetland clusters as representative (Figure 2-1). These included the Nile Delta, the Dinder wetlands, wetlands associated with Lake Tana, wetlands of the Baro, Akobo and Sobat rivers, but notably the Machar Marshes, the Sudd, wetlands of the Bahr el Ghazal, wetlands associated with Lake Kyoga, the Semliki wetlands, including Lakes Albert, George and Edward, wetlands associated with Lake Victoria, the Kagera wetlands, the Mara wetlands and the Sio Nzoia Yala Nyando wetlands cluster. The criteria used during the discussions for selection included the transboundary nature of wetlands, the severity of impacts and economic importance of wetlands and the hydrological influence on the system as a whole.

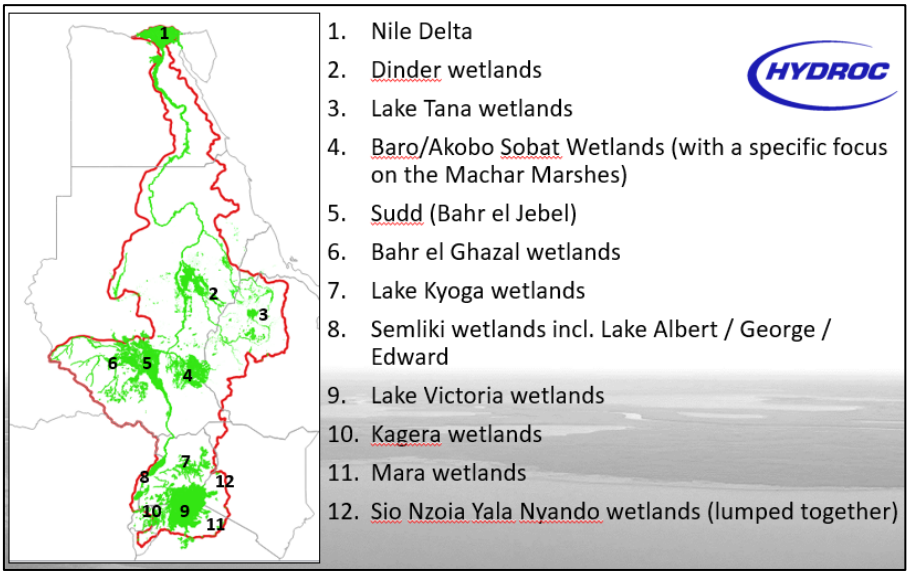


Figure 2-1. Layout of Wetland sites within the Nile River Basin

2.2 Study Area Description

2.2.1 Lake Victoria Wetlands

Lake Victoria is the world's second largest freshwater body with a surface area of 68,500 km^2 and a maximum depth of 84 m. Lake Victoria occupies a shallow depression in the East African Plateau and is the origin of the Nile River. The adjoining catchment area is 184,000 km^2 and has a shoreline length of 3440 km. The Lake Victoria drainage basin is shared between:

- Tanzanian with 51% and covers an area of 115,380 km^2,
- Uganda with 43% and covers an area of 31,000 km^2,
- Kenya with 6% and covers an area of 47,709 km^2 (Balirwa, 1995; Njiru *et al*. no date; Sitoki *et al.* 2010; Wakwabi, 2006).

Lake Victoria Basin can be divided into two habitat areas namely terrestrial and freshwater. Trees and grasses grow on the seasonal floodplains with stands of *Acacia (Vachellia)*. Key mammals found around Lake Victoria and its wetlands include hippopotamus, African clawless otter, spotted-necked otter, marsh mongoose, sitatunga, bohor reedbuck, defassa waterbuck, cane rats, and giant otter shrews. The area has a large population of Nile crocodiles, African helmeted turtles, various mud turtles and endemic to the area is Williams' mud turtle (http://www.feow.org/; Njiru *et al.* no date).

Lake Victoria supplies the single most important source of protein, namely fish and as such it is a major economic resource for its densely populated area (Balirwa, 1995; Sitoki *et al.*., 2010). The catchment area supports one of the densest and poorest rural populations in the world (Njiru *et al.*, no date). Socio-economic use of wetlands and floodplains include intense grazing and agricultural areas, particularly as market gardens.

The lake basin is estimated to have a population of 30 million people which is growing at > 3% per annum. The lake supports one of the most productive freshwater fisheries in the world with annual fish yields in excess of 500,000 tonnes. Other economic activities in the lake basin include agriculture, mining, hydropower generation and transport. Three major cities (Kampala, Kisumu and Mwanza) with a combined population of at least six million people depend on the lake for domestic and municipal water supply and waste disposal. The challenge on Lake Victoria is to sustain the lucrative fishery that emerged out of the *Lates niloticus* (Nile perch) introductions, and at the same time restore and conserve the lost fish diversity of Lake Victoria. Nile perch is sensitive to low oxygen which limit their distribution and interaction in these hypoxic habitats due to changes in the vegetation of the lake (Sitoki *et al.*, 2010).

Ecological changes in Lake Victoria's ecosystem have been linked to the introduction of fish species especially the predatory Nile perch. In addition, modern fishing methods and techniques have also had an impact on the ecological changes, with an increase in the surrounding human population, so the demand for food has increased and the dependence on the fish caught has increased (Balirwa, 1995; Sitoki *et al*., 2010). Wetlands may be a major source of material and substances that enhance fish production in the shallow lake zone and act as regulators of water quality for aquatic ecosystems. The original fish community had 300 species, mostly haplochromine cichlids and 14 cyprinids. By the 1950's target species (especially *Oreochromis esculentus*, *Oreochromis variabilis* and *Labeo victorianus*) numbers had drastically declined due to over fishing and modernisation of techniques, several tilapias (*Oreochromis niloticus*, *O. leucostictus* and *Talapia zillii*) and a predator the Nile perch were introduced to boost the fisheries. A recovery of the endemic tilapiines was attributed to the exceptionally heavy rains of the 1960's. From early 1980's improvement in the fisheries boosted by the introduced Nile perch and *Oreochromis niloticus* (Nile tilapia), was accompanied by a drastic reduction in the fish species diversity, particularly of the haplochromine cichlids. Other significant ecological changes include increased algal biomass (especially of cyanobacteria) and reduced oxygen levels approaching anoxia in bottom waters. Lake Victoria fisheries are presently based on three species: a small native pelagic cyprinid *Rastrineobola argentea*, the introduced *Lates niloticus* and *Oreochromis niloticus*. It has been suggested that removal of too many herbivores from the lake (particularly the tilapias) would slow the rate of biological production. Some previously submerged areas are now terrestrial patches and as such are no longer available as fish habitats (Balirwa, 1995).
Limnological data from both offshore and inshore stations indicate changed conditions of temperature and dissolved oxygen profiles and algae between 1960 and 1990. This suggests that the Lake Victoria system was already showing signs of stress before the Nile perch explosion of the late 1970's and early 1980's. A possible result of regional climatic changes or changes in water yield from the catchment is the increased stability of thermal stratification leading to a reduction of deep-water oxygen concentration. This would result in a reduction of the habitable space and cause fish to die (Balirwa, 1995; Sitoki *et al*., 2010).

Haplochromines are the dominant group breeding in inshore habitats and the introduced species *Oreochromis niloticus* and *Lates niloticus* are not found to be breeding in these areas (Balirwa, 1995). A reduction in the forest areas around the lake is also ascribed to the 1990's boom of Nile perch. The large Nile perch cannot be dried in the sun like the small haplochromines. They are therefore chopped into pieces and deep fried in their own fat while the smaller Nile perch are mainly smoked. For frying and smoking purposes, firewood use increased the deforestation along the lake's shore, exposing land to increased erosion and increased nutrients inputs into the lake (Njiru *et al.*, no date). Wetlands, particularly papyrus swamps, are a prominent feature of the marginal zones of Lake Victoria in Uganda. In Lake Victoria various aquatic macrophytes extending from land to a water depth of 1 to 2m are subjected to wave action and water level variations. The distance from the shore varies from 20-50m on rocky shores to 100-200m in sheltered bays and over sandy beaches. The swamp areas typically have *Cyperus papyrus* (Papyrus), *Phragmites* (Reeds), *Typha* (Bullrush) and *Vossia* (Hippo grass) (Balirwa, 1995). Most of the adjacent water bodies are surrounded by extensive papyrus swamps except for the steep sided Lake Simbi, which lies in a crater with hot springs that do not support papyrus growth. Lake Kanyaboli receives its waters from River Yala. The lake has no direct outlet but discharges its water to Lake Victoria through underground seepage. Most of the dams were sunk in the 1940s and 1950s to provide water for domestic and livestock uses.

Fish endemic to Lake Victoria were introduced into some of these dams and lakes to supplement fish yields and resource value. These water bodies now serve as the remaining refuge to those endemic species, now feared to have disappeared from the main Lake. The stocks in these waterbodies are well established and contribute immensely to the biological diversity.

Algae play an important role in the productivity of Lake Victoria and the small water bodies in the lake basin. They form the main part of phytoplankton in the open waters, whereas, in the littoral zone, algae are important in the benthos. Algae and macrophytes (Azolla, papyrus, and water hyacinth) are the major primary producers and the source of food in the Lake Victoria ecosystems. Several microalgae species such as *Oscillatoria*, *Microcystis*, *Aulacoseira*, *Nitszchia*, *Melosira* and *Pediastrum* are frequently encountered in the food items of detritivorous and phytoplanktivorous cichlids in Lake Victoria. Excessive algal proliferation (algal blooms) may cause death to a number of aquatic animals either due to lack of oxygen (at night) or from toxins. For example, in the 1990s, massive fish kills were observed in the Nyanza Gulf and attributed to the effects of the then cyanobacteria blooms. Cyanobacteria, especially *Microcystis* occur in high abundances in Lake Victoria and some of the surrounding water bodies. Global warming, climate change, and species introductions are believed to be the driving forces behind the phytoplankton blooms and driving domination by cyanobacteria. Fish species introductions enhanced changes in algal species composition through the trophic cascading. After the introductions of Nile perch and Nile tilapia, the endemic detritvorous and phytoplanktivorous haplochromine and tilapiine cichlids (*Oreochromis variabilis, O. esculentus* and *O. leucostictus*) were displaced and disappeared from the lake.

Submerged macrophytes are completely covered under water and rooted in the substrate. These macrophytes have thin finely dissected leaves adapted for rapid exchange of nutrients with water. Examples include *Ceratophyllum demersum* and *Najas horrida:*

- Floating leafed macrophytes are rooted but have their leaves floating on the water surface, for example *Nymphaea lotus* and *Trapa natans*.
- Free-floating macrophytes are a group of water plants that float on the water surface, they have buoyancy and are adapted to drift on the water surface, for example *Eichhornia crassipes* and *Pistia stratiotes*.
- Emergent macrophytes are rooted plants with their principal photosynthetic surfaces projecting above the water, for example *Phragmites australis* and *Typha domingensis.*

The haplochromines used to protect the inshore areas of the lake from the establishment of macrophytes by constantly disturbing the substrate (Witte *et al.*, 1992a). The heavy rains of 1961- 1964 caused a 2 m rise in the lake's levels and destroyed most aquatic plants especially floating leafed and submerged macrophytes in the littorals. Deforestation of the catchment and the resultant elevated soil erosion and heavy siltation of river mouths and shores of the lake, have lately contributed to extensive macrophyte establishment.

2.2.2 Mara Wetlands

The Mara Wetlands are an important transboundary wetland system between Kenya and Tanzania. It is shared between Kenya (65%) and Tanzania (35%). The catchment area is 9574 km^2 and the river length 198 km, with an average width of 5 km (MEMR, 2012).

There are two primary aquatic habitats in the Mara River Basin, namely the Mara River and the Mara Swamp. These two habitats are linked by a continuous network extending from the headwaters of the basin in the Mau Forest through the Mara Bay into Lake Victoria at Musoma. The source of the Mara River is Napuiyapui swamp in the Mau Forest Complex in Kenya. The Mara River meanders through the Masai Mara-Serengeti ecosystem before it's outfall in Lake Victoria at Musoma, Tanzania. The Amala and Nyangores Rivers are the perennial tributaries of the Mara, which drain the western Mau Escarpment and seasonal tributaries are Talek, Engare Nigoto and Sand Rivers (Abtew *et al.*, 2009; LVBC & WWF-ESARPO, 2010; MEMR, 2012; Dickens, 2010).

The Mara River is considered to be the lifeblood of the Masai Mara - Serengeti ecosystem that covers a catchment area of 25,000 km^2 (MEMR, 2012). In addition, this ecosystem plays a critical hydrological role, regulating the quality and flow of water into Lake Victoria (Tetra Tech, 2017). The wetland system includes floodplain grassland, woodland, swamp and open water, of which half is permanently inundated. It is one of the largest remaining tracts of papyrus swamp in sub-Saharan Africa. Dryland areas contain mosaic of mixed woodland and shrubland, interspersed with crops and pasture (Tetra Tech, 2017).

The extent and composition of the Mara Wetland system varies on a seasonal basis and over time. The inundated area expands and contracts each year in line with the two rainy seasons (September - December and March - June). Only a few permanent wetlands occur where water is trapped at the surface by the black cotton soil or where underground streams emerge (MEMR, 2012; Tetra Tech, 2017).

Over the last 30 years, the wetland has more than doubled in size and spread into areas previously occupied by shrubland and grassland. The landscape hosts a rich array of fauna and flora. The dominant plant species are *Cyperus papyrus*, *Typha domingensis* and *Phragmites australis*. The alien *Sesbania sp* occurs on the swamp's outer edges (Tetra Tech, 2017). This wetland system is home to a high concentration of non-migratory predators for example *Panthera leo* (African lion), *Panthera pardus pardus* (leopard), *Acinonyx jubatus* (cheetah) and *Crocuta crocuta* (spotted hyena). The resident mammals include *Loxodonta africana* (elephant), *Diceros bicornis* (black rhino), *Giraffa camelopardalis tippelskirchii* (Masai giraffe), *Nanger granti* (Grant's gazelle), *Eudorcas thomsonii* (Thomson's gazelle), *Hippopotamus amphibious* (hippopotamus) , the endangered *Tragelaphus spekii* (sitatunga) , *Anubis baboon* (olive baboon) , *Cercopithecus aethiops* (vervet monkey) , *Phacochoerus africanus* (warthog) and *Damaliscus lunatus jimela (*topi). (Gichuki, 2009; LVBC & WWF-ESARPO, 2010; MEMR, 2012; Tetra Tech, 2017).
Hippopotamus are known to limit fire incidences by removing the grass layer. They are threatened by loss of habitat and water pollution. The Sitatunga feeds on wetland grasses, herbs and shrubs which is threatened by anthropogenic activities. The Clawless otter populations are declining due to amongst others increased turbidity of water. The Spot-necked otter are threatened by turbidity, fish nets and destruction of shoreline-breeding/feeding ground. The Marsh mongoose is under threat due to loss of habitat (Gichuki, 2009).

The profuse birdlife include *Nettapus auritus* (African Pygmy Goose) *)*, *Balearica regulorum* (Grey-crowned Crane) , *Psittacus erithacus* (Grey Parrot) , *Balaeniceps rex* (Shoebill) , *Ciconia episcopus* (Woolly necked Stork), *Polemaetus bellicosus* (Martial Eagle), and *Calamonastides gracilirostris* (Papyrus yellow warbler) (MEMR, 2012; Tetra Tech, 2017).

The Mara wetlands are an integral part of a large and important fisheries industry which is dependent on the inflows from the Mara River (Dickens, 2010). Fish species of conservation and economic importantance are *Protopterus aethiopicus, Clarias gariepinus, Oreochromis niloticus, O. variabilis, O.leucostictus, O.esculentus*,*Lates niloticus, L. victorianus, Bagrus docmac, Synodontis intermedius, S. victoriae and S.afrofisheri*(Tetra Tech, 2017).

The Mara wetland reptiles include *Crocodilus nilotics* (Nile crocodiles). The wetland's amphibians and reptiles are threatened by pet trade*. Some of these species include Hyperolius lateralis, Leptopelis mackayi, Varamus niloticus, Atheris hispida, Atheris squamiger, Bitis gabonica, Bitis nasicornis, Causus lichtensteinii, Boiga blandigii, Boiga Puvurulenta, Hapsidophrys lineata, Harmonotus modestus, Philothamnus heterodermus carinatus, Polemon christyi, Thrasops aethiopissa elgonensis, Pseudohaje goldi* and *Python sebae* (Gichuki, 2009).

The land use in the Mara wetlands is cultivation, livestock, forestry, fishing, dairy farming and gold mining. Land use changes have resulted in erosion of forests, grasslands, shrubland and savannah. There is an ever-increasing pressure and growing demand on the wetland due to an increasing population. Human-induced habitat loss and degradation threaten the abundance of wildlife species, biodiversity, water resources and watershed systems. Climate change will add to this degradation (Abtew *et al*, 2009; MEMR, 2012; Tetra Tech,

2017). Agricultural encroachment is currently estimated at more than 100 km^2 of the wetlands. Overgrazing impacts grasslands in addition to uncontrolled burning to create better pasture. Upper catchment degradation and deforestation, coupled with agricultural intensification and expanding human settlement, have led to increased silt, sediments, nutrients and pollution loads reaching the lower basin (Tetra Tech, 2017). Loss of forest cover in the Mau Forest Complex has reduced hydrological flow in the Mara River. The forested part of the Mara Basin has decreased from 752 km^2 in 1973 to 493 km^2 in 2000. This forest cover reduction in the headwaters has reduced the base flow and water quality in the river. Water scarcity is a cause of conflict between wildlife tourism and livestock farming (MEMR, 2012; Dickens, 2010).

The annual migration of more than 1 million wildebeest, over 200,000 zebras and 400,000 Thomson gazelles starts in April and May, migrating westward from the Ndutu Plain in Tanzania reaching the Mara River in July or August and continues northwards, eventually crossing the border into Kenya's Masai-Mara National Reserve in September or October. This migration has been linked to water availability and water quality. During severe droughts, which occur every six or seven years, when even pools dry up, the Mara River is the only source of water in the region and is essential for the survival of the migrants (Dickens, 2010; LVBC & WWF-ESARPO, 2010; MEMR, 2012).

2.2.3 Kagera Wetlands

The Kagera River basin rises above 2 500 m in the west, with peaks up to 4 500 m. The annual rainfall for the basin is less than 1 000 mm in the east but rises to 1 800 mm in the west. There are two rainfall seasons, namely February–May and September–November, but the runoff, which reaches a peak in April in the upper reaches, is delayed by lakes and swamps formed by drainage reversal to May at Rusumo Falls, and by further lakes and swamps to July at Kyaka Ferry above the mouth of the river (Sutcliffe, 2009).

The Kagera River is the major tributary to Lake Victoria and the furthest source of the Nile River. It drains the mountains of Rwanda and Burundi, flowing north through a shallow swampy valley containing major and minor lakes, before turning east near Kakitumba to flow to Lake Victoria. It enters the lake through a valley swampland near the midpoint of the western shore. The Kagera wetlands and lakes covers an area of 1444 km^2 of which 500 km^2 is lake surface. The wetland system lies in a north-south anticline defining the Rwanda/Tanzania border between two ridges of low hills, below Rusumu Falls. The Kagera River meanders along the centre of the flat-bottomed valley for about 180 km, spilling over to inundate a swamp belt 2-18 km wide. This swamp belt is lined on each margin by a series of substantial papyrus fringed lakes, the right bank being situated in Tanzania. The swamp belt is more extensively developed on the left bank, in Rwanda, where lakes occur. Some of these lakes are fringed by seasonally inundated savannas. Very few of the lakes have permanent connections with the Kagera River. 600 km^2 of swampland is protected in the Akagera National Park in Rwanda while 350 km^2 of the unprotected wetland is situated in Tanzania (Hughes & Hughes, 1992; Sutcliffe, 2009).

The Sango Bay Musambwa Island Kagera wetlands are a system of seasonal or intermittent freshwater lakes (Rebelo & McCartney, 2012). Many small seasonal streams feed the lakes or swamps directly and flow twice a year, the bulk of riverine flow is from Kagera River which rises in response to seasonal rains. The area lies in the transition between the East and West African vegetation zones and this biogeographical ecotone makes it biodiversity rich. The flagship species are *Balaeniceps rex, Balearica regulorum, Crocodylus niloticus, Cyperus papyrus, Hippopotamus amphibius, Nettapus auritus, Oreochromis esculentus, Oreochromis variabilis* and *Tragelaphus spekii.*

The majority of the Kagera wetlands consist of Papyrus swamp with many islands of floating vegetation. The *Cyperus papyrus* (papyrus) grows 4-5m tall, with an understorey of *Cyclosorus interruptus* up to 1.5 m with *Ipomoea rubens* climbing to 4 m with *Polygonum* spp. *Echinochloa crus-pavonis*, *Hydrocotyle ranunculoides*, *Leersia hexandra*, *Utricularia inflexa* and *Vossia cuspidate* occur in the water along the outer margins of the papyrus. *Miscanthidium violaceum* are rooted in the shallower parts of the swamp. Although the swamps are dominated by papyrus, there are patches of swamp forest and seasonal floodplains outside of the permanent swamp system. Groves of *Phoenix reclinata* and thickets of *Aeschynomene elaphroxylon*, *Dissotis*

incana, *Ficus verruculosa* and *Myrica kandtiana* occur on the margins, levees and island shores. Permanent deep water is covered by carpets of floating *Lemna paucicosta, Ludwigia stolonifera*, *Nymphaea caerulea*, *N. nouchali*, *Pistia stratiotes* and *Trapa natans* with submerged *Ceratophyllum demersum*, *Myriophyllum spicatum*, *Potamogeton pectinatus, Utricularia spp.* and *Vallisneria spiralis* (Hughes & Hughes, 1992). Two endangered orchids are recorded from the wetlands, namely *Eulophia angolensis* and *Eulophia guineensis* (REMA, 2018).

The savannas surrounding the lakes are subject to seasonal inundation and are dominated by *Acacia campylacantha* and *A. sieberiana* with *Boerhaavia plumbaginea, Bridelia micrantha, Cordia abyssinica, Crassocephalum bojeri, Panicum deustum, Securinega virosa, Setaria kagerensis* and *Sorghum verticilliflorum*. The grasses *Hyparrhenia filipendula* and *H. rufa*, or *Bothriochloa insculpta* and *Themeda triandra* are found on the peripheral floodplain (Hughes & Hughes, 1992). The Sango Bay Musambwa Island Kagera wetland system is classified as an Important Bird Area. This wetland system supports large numbers of waterbirds for example 16.5% of the *Larus cirrocephalus* (Grey-headed Gulls) population. The endangered *Balaeniceps rex* (Shoebill), *Laniarius mufumbiri* (Papyrus gonolek) and *Balearica regulorum* (Grey Crowned Crane) occur within the wetland. European migrant birds that can be found using the wetlands include *Hippolais icterina*, *Hirundo rustica*, *Motacilla flava*, *Phylloscopus trochilus*, *Riparia riparia* and *Sylvia borin*. Other birds that are found within the wetland system include *Anhinga rufa, Ardea goliath*, *Ardeola ralloides*, *Balearica regulorum*, *Ceryle rudis*, *Haliaeetus vocifer*, *Pandion haliaetus*, *Phalacrocorax africanus*, *P. carbo*, *Plectropterus gambensis* and *Quelea erythrops*. (BirdLife, 2019; Hughes & Hughes, 1992).

A species rich fauna (mammals) diversity occurs within the Kagera wetlands with some of the species being Black-and-white Colobus Monkey and a subspecies of the Blue Monkey. The endangered *Tragelaphus spekii* (sitatunga) occurs along with *Hippopotamus amphibious* (hippotamus) , *Hippotragus equinus* (Roan antelope), (*Kobus ellipsiprymnus* (Water buck), *Loxodonta africana* (African elephant), *Panthera paradus* (leopard), *Redunca arundinum* (Southern reedbuck), *Sylvicapra grimmia* (Common duiker), and *Syncerus caffer* (African buffalo). In addition, water turtles (*Pelusios*), crocodiles, monitors, snakes, otters and rodents also occur within the wetlands. The *Phrynomantis bifasciatus*is frog is restricted to the Akegera wetlands (Hughes & Hughes, 1992; Ramsar, 2019).

Two of the important fish species found within the Kagera wetlands are *Labeo victorianus* (critically endangered) and *Synodontis ruandae*, a fish species endemic to the Akagera River System. Other fish species found include *Lates niloticus, Oreochromis niloticus Bagrus docmak*, *Mastacembelus frenatus*, *Clarias liocephalus*, *Marcusenius victoriae*, *Pollimyrus nigricans. Brycinus jacksonii*, *Labeo victorianus*, *Synodontis afrofischeri*, *Petrocephaluscatostoma*, *Schilbe intermedius.* The number of species in each ichthyogeographic sub-unit is strongly linked to altitude and specie numbers are low in the higher altitudes (De Vos *et al*, 2001; REMA, 2018). Controlled fishing occurs on Lake Ihema, within the Akagera National Park, but otherwise fishing is illegal within the park. Outside of the park fishing is uncontrolled and overfishing occurs. Local fishermen keep channels open through the vegetation, connecting the various lakes for fishing (Hughes & Hughes, 1992).

The floor of the high valley of the Nyawarungu/Kagera River is inundated in the wet seasons but is intensively cultivated in the long dry season. There are mine workings along it at several points. Swamps in some tributary valleys along its upper course have been drained, mostly for agricultural purposes, with the resultant problems of increased erosion, and decrease in soil fertility because silt is no longer deposited. Along the swampy middle course, some areas are being cultivated for rice and many drier sites have been converted for sugar cane (Berakhi, 2015; Hughes & Hughes, 1992).

Changes in the Kagera wetland area have been observed by the local farmers. The farmers have noted that there were longer rains in the past and that the rain is now less reliable. The rivers and surrounding swamps dry out as a result of the reduced rain. The watercourses and water bodies have been reduced in size due to infestation by water hyacinth. The harvested water hyacinth is used as animal fodder and in craft making. There is an increase in soil erosion and vegetation loss due to increasing population pressures and resource

exploitation (Hughes & Hughes, 1992). The Kagera wetlands mainly provide fish and game meat to neighbouring communities. In some parts wild game is almost extinct due to over harvesting. Among other things, the wetlands are an important source of food security for surrounding communities. However, the increasing population growth from both nationals and immigrants is creating pressure on the land for agriculture, cattle herding, commercial firewood, charcoal and deforestation for traditional medicines (http: africa.wetlands.org; NBI, 2019).

The Kagera wetlands provide the following ecosystem services:

- helps to reduce silt load of Lake Victoria;
- flood control;
- erosion control;
- ground water recharge;
- water purification (NBI, 2019).

The Kagera wetland provides the following supporting services:

- pollination;
- primary production;
- soil formation;
- habitat function to aquatic flora and fauna (NBI, 2019).

The cultural importance of the Kagera wetland includes the use of the wetlands for the baptizing of people by dipping in them in swamp water in order to acquire blessings. Community members also perform cleansing rituals like bathing in the wetland to remove bad luck (NBI, 2019).

2.2.4 Sio Nzoia Yala Nyando Wetlands

Sio

The Sio River originates from Mount Elgon in Kenya and is 85 km long and the catchment area is 1 338 km^2. It flows into Lake Victoria at Berkeley Bay. The Sio wetland has two wetland types namely: riverine and palustrine (MEMR, 2012; Obando *et al.*, 2007; Ojwang *et al.*, 2009; Okeyo-Owuor *et al.*, 2012). The predominate vegetation found in the Sio wetland is *Cyperus papyrus* papyrus, *Phragmites spp*. (reeds) and *Vossia cuspidata* (hippo grass). Invasive species such as *Eichhornia crassipes* (water hyacinth), *Pistia stratiotes* (water lettuce) and woody shrubs have invaded the wetland (Oindo, 2009).

The Sio wetland is identified as an Important Bird Area as it has more than 300 bird species which include three papyrus endemics: *Laniarius mufumbri* (Papyrus Gonolek), *Bradypterus carpalis* (White-winged Warbler) and *Crithagra koliensis* (Papyrus Canary). *Circus macrourus* (Pallid Harrier) is also listed as an important bird species and *Phalacrocorax africanus* (Long-tailed Cormorant) has the greatest number of individuals present at the wetland. The mammals that occur within the wetland include *Tragelaphus spekei* (sitatunga), *Chlorocebus pygerythrus* (vervet monkey), otter, *Hippopotamus amphibius* (hippopotamus) and *Atilax paludinosus (water* mongoose) (MEMR, 2012; Ndithia, 2009).

The services provided by the Sio wetland include storing and purifying water that flows into Lake Victoria. The major wetland uses are fishing, large scale farming, mining, brick making, forestry, tourism and recreation, irrigation, hydropower, harvesting of papyrus reeds and artisanal products. The hydrological characteristics of the Sio wetlands have changed due to canal construction, over-abstraction of water and sand harvesting. These changes result in water level fluctuations and impervious surfaces impacting on crops (MEMR, 2012). The agricultural crops grown in the Sio wetland are arrowroot, sugar cane, potato, maize and millet. Subsistence cropping has developed to include large scale cash crop farming as more wetland conversion to agriculture takes places (MEMR, 2012; Obando *et al*, 2007; Oindo, 2009).

The population density within the Sio area exceeds 300 people/km^2 and cattle number 38/km^2 (Obando *et al*, 2007). The anthropogenic pressures on the Sio wetland include inappropriate land use and overutilization; conversion of wetlands to agricultural land; unsustainable exploitation of resources; land subdivision and

fragmentation. The subsequent impacts are pollution; loss of land cover; invasive species; reduced water quantity and quality; loss of biodiversity, reduced fisheries and increased risk of flooding (MEMR, 2012).

Nzoia

The Nzoia River is 315 km long and the catchment area is 12 696 km^2, the headwaters drain Mount Elgon, the Cherangani Hills and the northern sections of the Mau Forest Complex. The Nzoia River drains into the northern basin of Lake Victoria and it is the largest sub-basin in the Lake Victoria basin. Nzoia wetland is 20 km long from north west to south east and 1-5 km wide. The wetland used to extend to about 60 km^2, it is estimated that 40 km^2 is now under agriculture. The Nzoia River has deltaic sediments which are deposited in Lake Victoria (Hughes *et al*, 1992; MEMR, 2012; Ojwang *et al*, 2009). The Nzoia wetland is described as a riverine wetland, it has both a floodplain and a permanent swamp. The main vegetation of the Nzoia wetland include *Cyprus Papyrus* (papyrus), (*Phragmites sp* (reeds) () and *Vossia cuspidata* (hippo grass) (Kairu, 2001; MEMR, 2012; Ojwang *et al*, 2009). Deforestation of the Mau Forest Complex has reduced water flow into the Nzoia wetland. Flooding occurs annually and the extent fluctuates widely. Dykes have been constructed in order to protect adjacent communities, property and infrastructure. Despite the dykes, the river breached these in 2008 (MEMR, 2012).

Mammals found in the Nzoia swamp include *Hippopotamus amphibius* (hippopotamus), *Tragelaphus spekeii* (sitatunga) and *Aonyx capensis* (clawless otter). The Nzoia swamp is one of only two known locations for *Potamogale velox* (Giant Otter shrew) the other known location is the Yala wetland. Loss of foraging areas due to conversion of wetland to agricultural and human settlement, hunting for meat and water pollution from chemicals threaten the hippopotamus numbers (Agwanda, 2009).

Although some fish species in Lake Victoria have been reduced or are now extinct, wetlands such as Nzoia provide a refuge for many of these 'lost' species. Examples of fish species found in the Nzoia wetland include: *Pseudocrenilabrus multicolor, Chiloglanis cf. somereni, Amphilius cf jacksonii, Barbus altianalis, Barbus apleurograma, Clarias gariepinus, Labeo victorianus* and *Schilbe intermedius* (Ojwang, 2009).

Wetland uses include fishing, large scale farming, mining, harvesting papyrus reeds, brick making, forestry, conservation – Kakamega forest, tourism and recreation, irrigation, hydropower, artisanal products. These wetland uses cause the following pressures: inappropriate land use and overutilization, conversion of wetlands to agricultural land, unsustainable exploitation of resources, land subdivision and fragmentation. The resulting impacts are pollution, loss of land cover, invasive species, reduced water quantity and quality, loss of biodiversity, flooding and reduced fisheries (MEMR, 2012). The Nzoia basin is within a sugarcane growing region and has a floodplain in Budalangi. The conversion of wetland to medium scale sugarcane farming has increased from 84 km^2 in 1986 to 189.5 km^2 in 2005. There was a reduction in riverine vegetation from 3.6 km^2 in 1995 to 1.4 km^2 in 2005. The environmental challenges on Nzoia River are caused by pollution from discharge of poorly treated effluent from sugarcane, pulping, coffee processing factories and agricultural chemical run-offs. Effluents are from the major industries in the basin but from outside the district namely paper mills, tobacco leaf factories and cotton ginnery have degraded the environment of the basin due to improper management of industrial waste. The waste is discharged into the river and the atmosphere. Soil samples also have high levels of persistent organic pollutants. The pollutants have profound impacts on the fishing industry, killing fish in Nzoia River with the water unusable for any purpose for at least 20 km from Webuye. There have been records of fish dying at the mouth of the river. Cattle owners also find it hard to water cattle in some sections of the river (Twesigye *et al*, 2011).

Yala

The Yala wetlands have been described as a biological museum because of its rich diversity of haplochromine cichlids, most of them threatened or thought to be extinct in Lake Victoria (Okeyo-Owuor *et al*, 2012.). The catchment area of the Yala River is 3,262 km^2 and the river is 261km long. The river headwaters are the Mau Forest Complex and the Kakamega Forest, and it drains into Lake Victoria. The Yala wetland surface area is 15 km^2 and the maximum depth is 3 m. The wetland contains three freshwater lakes namely Kanyaboli (the only lake in the system to be gazetted as a national reserve), Sare and Namboyo. The Nzoia Delta, the

lakeshore south to Ugowe Bay and the land to the east of Lake Kanyaboli form part of the Yala wetland. The Yala wetland covered an area of 175 km^2 as natural wetland up until the mid-1960s. It is estimated that at least 140 km^2 of the Yala wetland can be made productive, and by 1980, 3.8 km^2 had been converted for rice production. In 2002, 100 km^2 was leased to Dominion Farms (K) Ltd (Abila, 2002; Hughes *et al*, 1992; Kinaro, 2008; MEMR, 2012; Ojwang *et al*, 2009; Thenya *et al*, 2017).

The Yala catchment area can be divided into two precipitation areas namely high precipitation in the Northern highlands with 1 800 – 2 000 mm per annum and low precipitation in the South-Western lowlands with 800 – 1 500 mm per annum. There are three distinct rain seasons, namely the 'long rains' from March to May, 'short rains' from October to November and the dry season from December to February (Thenya *et al*, 2017).

The Yala wetland comprises three wetland types namely: lacustrine, palustrine and riverine. The wetland is an ecotone zone between the uplands of the Lake Victoria Basin and the deep water aquatic system of Lake Victoria (Kinaro, 2008; Okeyo-Owuor *et al*, 2012). The Yala wetland is located on the deltaic sediments of the Nzoia and Yala Rivers, and has hydric soils which are considered to be a lifeline for its neighbouring communities. A clay is found in the wetlands containing minerals required by animals which the cattle use as a salt lick (Abila, 2002; MEMR, 2012). The mammals found within the Yala wetlands include *Panthera pardus pardus* (leopard), *Hippopotamus amphibius* (hippopotamus), *Kobus ellipsiprymnus* (waterbuck), *Tragelaphus spekeii*, (Sitatunga, (one of the few refuges in Kenya), *Aepyceros melampus* (impala), *Aonyx capensis* (clawless otter) (hedgehogs, *Cercopithecus aethiops* (vervet monkey), mongoose, squirrels and wild pigs. The Yala wetlands are one of two known locations for *Potamogale velo* (Giant Otter shrew). Amongst the reptiles found is the *Python sebae* (African rock python) (Abila, 2002; MEMR, 2012; Mwaura *et al,* 2003).

The Yala wetland is listed as an Important Bird Area due to the presence of key bird species, namely *Laniarus mufumbiri* (Papyrus Gonolek), *Calamonastides gracilirostris* (Papyrus Yellow Warbler), *Ardea alba* (Great White Egret) and *Zapornia pusilla* (Baillon's Crake) (Ndithia, 2009). Other birds found in the Yala wetland are *Corythornis cristatus* (Malachite Kingfisher), *Ceryle rudis* (Pied Kingfisher), *Ceryle rudis* (Grey Crowned Crane). Birds that are targeted for hunting include waterfowl, guinea fowl and *Coturnix delegorguei* (harlequin quail) (Abila, 2002; Mwaura *et al,* 2003).

The vegetation in the wetland comprises several species of *Cyperus papyrus, C. dives, C. exaltatus and C.distan, Phragmites spp*. and *Typha spp.* Medicinal wetland plants found within the Yala wetland include *Cassia siamea, Carisa mangium, Flemingia grah, Senna didymobotrya, Rosa canina, Abrus prec, Salium elli, Albizia coriaria, Talinum triangulare, Vernonia hild, Aloe spp, Centaurea cyanus, Centaurea kirkii* and *Amaranthus dubius* (Abila, 2002; Mwaura *et al,* 2003; Thenya *et al*, 2017).

Land cover changes at Yala wetland between 1973 to 2001 are recorded as follows (Thenya *et al,* 2006):

Land cover	Total hectares (ha) - 1973	Total hectares (ha) - 2001
Open water	2 672.06	2 200.94
Silt water	569.32	542.99
Conversion of cropland & settlement	1 564.23	5 939.84
Bushes – Eucalyptus –phoenix - hibiscus	1 652.60	2 462.60
Sedges – Papyrus – phragmites - typha	7 180.20	4 999.93
Sedges – Latifolia – papyrus - phragmites	3 959.87	3 435.64
Bushes – Latifolia – sesbania interface	4 343.60	2 359.96
Total	21 941.89 ha	21 941.89 ha

An increasing floating vegetation mass is evident in the reduced open water and silt water areas. The increase in "Bushes – Eucalyptus –phoenix – hibiscus" community may be an indicator of either increased colonisation of disturbed areas or less flooded eco-types. *Lantana camara*, an invasive alien weed is found in the cultivated areas around the wetland. The main grass species to be found in the wetland are *Paspalum scrobiculatum, Cynodon dactylon, Leersia hexandra* and *Digitaria scalarum.* In the grass areas *Commelina spp, Cyperus radiata* and *Solanum incunum* also occur. Lindondo and Limuhuayo are used for dying twines in papyrus products and are also sold separately. *Markhamia lutea* is used for sticks in table manufacturing (Mwaura *et al,* 2003).

About four species of fish have disappeared after the diversion of the Yala River in 1973. Other species that still occur but in smaller numbers and sizes include *Clarias alluaudi, Oreochromis esculentus, Clarias gariepinus*, *Haprochromis spp*. Lake Kanyaboli is the only known location for the endemic and endangered paedophagous haplochromine *Lipochromis maxillaris* (Mwaura *et al,* 2003; Ojwang *et al,* 2009).

The impact of rehabilitation of the wetland had negative effects on the vegetation too. Some tree species that were associated with the lacustrine zone have locally disappeared including *Ficus. thuningi*, *Acacia polyacantha* and *Ranunculus aquartilis* (Mwaura *et al,* 2003). The crops grown within the reclaimed wetland areas are cabbage, kale, tomatoes, banana, sugar cane, arrow roots, sweet potatoes, yams, cassava, cow peas, maize, oil crops (groundnuts, simsim), onions, beans and millets. The livestock that graze within the wetland are cattle, sheep and goats (Mwaura *et al,* 2003; Thenya *et al*, 2017). Land around the Yala wetland is acquired by the local population through self-allocation and later passed on through inheritance along kinship lines. As there is no management strategy for the swamp, this leads to over exploitation of the land resulting in uncontrolled land allocation, farming and grazing (Thenya *et al*, 2017). The major wetland uses are fishing, medicinal herbs, large scale farming, mining, brick making, forestry, tourism and recreation, irrigation, hydropower and artisanal products. Papyrus is used extensively for making of products such as mats and for animal fodder (MEMR, 2012).

The population density around the Yala wetland is estimated to be 240 people / km^2. There is an increasing population pressure on the wetland's services as more people search for fertile land for farming and livestock keeping (Kinaro, 2008). The anthropogenic pressures on the Yala wetland include inappropriate land use and overutilization; conversion of wetlands to agricultural land; unsustainable exploitation of resources; land subdivision and fragmentation. The subsequent impacts are pollution; loss of land cover; invasive species; reduced water quantity and quality; loss of biodiversity, reduced fisheries and flooding (MEMR, 2012).

Nyando

The Nyando wetland is located in Nyanza Province, western Kenya, and is found at the mouth of Nyando River at Nyanza Gulf (on the eastern part of Lake Victoria). The wetland measures 15 km from west to east and 6 km from north to south (Hughs *et al*, 1992; Ojwang *et al*, 2009). Its size varies from 30 km^2 in the dry season to 50 km^2 in the wet season. In the 2008 dry season, its size was estimated to be 42.12 km^2 (Rongoei *et al*, 2013). The Nyando wetland has two wetland types, namely riverine and palustrine (Okeyo-Owuor *et al*, 2012).

The rain season is divided into March-May ("long rains") and October-December ("short rains"). During these wet seasons, flooding of Nyando River creates connectivity between the various wetlands and the river (Rongoei *et al*, 2013). The two major rivers, Nyando and Awach, have their catchment areas in the Nandi Hills which have high rainfall. These rivers have a strong influence on flooding in the wetlands. Poor farming practices and deforestation on the upper Nyando River catchment area has led to heavy siltation in the rivers and the silt is eventually deposited in the wetland. Flooding often occurs during the long rainy season with a peak in April-May. The unsustainably high rate of irrigation development along the Nyando River, together with the excess siltation, upstream residential runoff and industrial and sewage discharges, affect the quality of Lake Victoria's water (Masese *et al,* 2012; MEMR, 2012). Singida, about 3 km east of Ogenya, is influenced by the Bwaja stream that joins Nyando River before entering Lake Victoria. This site becomes inundated

during the wet season, with water levels up to 79 cm above the soil surface, but dries up in the dry season. The vegetation is dominated by *Cyperus papyrus* which is mainly rooted and *Ipomoea wrightii* with *Vossia cuspidate* along the edges of the Bwaja River. On the landward side, natural vegetation has been replaced with crops (Rongoei *et al*, 2013). Ogenya at the shore of Lake Victoria is influenced directly by wind related positive water balance (seiche effect) that inundates the littoral zone. The drying and wetting of the *C. papyrus* at the edge of the wetland makes this site different. Papyrus vegetation comprises the rooted zone towards the terrestrial zone and a floating mat at the lake fringe. Water levels above the soil surface fluctuate on a daily basis between 20 and 65 cm depending on the magnitude in the seiche effect associated with the wind action blowing on the lake surface. There is a distinctive zonation of plants from floating *Eichhornia crassipes, Pistia stratiotes* and *Nymphaea sp*. to emergent *Vossia cuspidata* at the edge of the lake and along the Aguko channel. *Cyperus papyrus* stands float at the lake edge and are rooted at the landward side in association with patches of *Phragmites sp*. and *Typha sp*., including a strip of *Sesbania spp*. and *Triumffeta sp*. The wetland-terrestrial interface and abandoned farms are characterised by occurrence of *Cyperus latifolius* and *Cynodon dactylon*. The area of the permanently and seasonally flooded zones varies with dry and wet seasons (Rongoei *et al*, 2013).

Wasare approximately 15 km east from the edge of Lake Victoria, is influenced by the annual flooding of Nyando River. There is a rapid rise in the gradient on the landward site restricting the river into the floodplain. The water depth above the soil surface ranges between 0 and 45 cm. The floodplain is dominated by trees such as *Acacia seyal, Balanites aegyptiaca, Euphorbia sp*., *Makhamaia sp*, *Thevetia peruviana* and *Eucalyptus sp*. In the wet season, *Cyperus papyrus* dominates the wetland in association with *Azolla sp., Nymphea sp., Ipomoea aquatica, Vossia cuspidate* and *Polygonum sp*. However, the plant composition changes in the dry season to species like *Leersia hexandra, Amaranthus spinosa* and *Cyphostema babuseti* after clearing and burning of the wetland ecosystem. Since burning does not affect the rhizomes, papyrus will regenerate at the onset of rain enabling it to dominate again. However, the papyrus rhizomes are collected for firewood and thus not given a chance to regenerate (Masese *et al*, 2012; Rongoei *et al*, 2013).

According to the community members, Nyando wetland historically was restricted to the narrow strip along the shores of Lake Victoria and along the river channels. However, with the heavy rains experienced in 1962-1963, the wetland expanded landward resulting in loss of croplands, settlements and even lives. Connectivity seems to be limited for the Nyando wetland, which is flooded once or twice annually, and only for a period of approximately two weeks. Dykes have been constructed on both sides of River Nyando to restrict overtopping of the river (Rongoei *et al*, 2013).

In terms of ecological functions, Nyando wetland is a habitat for a variety of flora and fauna. Thirty macrophyte plant species have been identified in the Nyando floodplain wetland. These macrophytes form a habitat for *Tragelaphus spekeii* (sitatunga), and to papyrus endemic bird species such as *Bradypterus carpalis* (White-winged Warbler) and *Laniarus mufumbiri* (Papyrus Gonolek).) Reptiles found in the wetland include *Python sebae* (African rock python) (MEMR, 2012; Rongoei *et al*, 2013). Fish species found in the Nyando wetlands include *Xenoclarias sp.; Synodontis afrofischeri; Clarias gariepinus; Protopterus aethiopicus, Barbus cercops, Rastrineobola argentea, Oreochromis niloticus, Clarias gariepinus*, and juveniles of *Lates niloticus* (Masese *et al*, 2012; Rongoei *et al*, 2013).

The Nyando wetland ecosystem services include food, water, fuelwood, building materials and herbs. Food products that are directly extracted from the wetland are wild vegetables, including *Solanum nigrum*; fish (main species are the lungfish *Protopterus aethiopicus*, catfish *Clarias gariepinus*, and *Schilbe intermedius)*, wild meat is from Sitatunga, hippopotamus, birds and insects. Farming occurs in the seasonally flooded wetland with sugarcane grown commercially and mainly sold to sugar processing industries that have expanded into the macrophyte zone over the recent years. Rice and tea are also grown on a commercial scale. The crops grown include cotton, maize, beans, kales, cassava, sorghum, green yams, pumpkin, sweet potato, cow peas, tomatoes, banana trees, mango trees and arrow roots (Rongoei *et al*, 2013). Papyrus biomass is harvested for making mats, furniture, wall hangings, ropes, brooms, fish traps, fencing and thatching. Other emergent macrophytes harvested for use by local people include *Phragmites sp.* (fish traps

and fencing), *Vossia cuspidata* (livestock fodder) and *Cyperus sp*. (thatching). Medicinal plants collected from the wetland are used to treat and prevent ailments, including snake bites. These include plants such as *Cyphostema suaveolens, Solanum nigrum* (herb and vegetable), *Senna sp*. and *Sphaeranthus sp*. The Nyando wetland is important for domestic water supply and irrigation either through direct abstraction from the river and pools or shallow wells dug in the wetland periphery (Masese *et al*, 2012; Rongoei *et al*, 2013).

Nyando wetland plays an important role in the tradition and culture of the Luo community, who use the wetland for spiritual cleansing and rituals. They are also depended on the lake and wetland fisheries for protein, employment and income. The Nyakach community use the African rock python to predict weather patterns (Rongoei *et al*, 2013).

Overtime, plant species composition in the wetland has changed. Alongside the loss of native species, new plant species were introduced. *Thevedia peruviana*, which is not a wetland plant, dominates areas around homesteads. This plant is used for live fences and serves as an insect repellent. Other introduced plants include *Eucalyptus sp*., *Azadiractai indica* and *Schefflera actinophylla*, which are used for construction (housing, boats), fencing, furniture, firewood and charcoal production. These plants are exotic and are not wetland plants but are grown near homesteads and at farm boundaries. Other introduced species like *Eichhornia crassipes, Pistia stratoites* and *Azolla sp*. dominate open water lakes, pools and river channels. Some new animal species have also been noticed, including *Lepus sp* (African hare) and *Paraxerus sp* (squirrel) *(*Rongoei *et al*, 2013). In the dry season, shrubs and grasses occur and invasive *Xanthium pungens* and *Mimosa pigra* are prominent which the local community considers a nuisance to farming and livestock production. *Mimosa pigra* is utilised as firewood and browsed by goats, *X. pungens* covers the grassland and compromises the grazing land (Masese *et al*, 2012).

There are three main categories of drivers of change that influence ecosystem functions and services in the Nyando wetland: hydrology, demographic changes and associated livelihood activities in the wetland. The major hydrological event that shaped Nyando wetland was the El Niño rains of 1962-1963 coinciding with the commissioning of the Owen Falls dam in Uganda, leading to a 2.3m rise in lake level. This increase in water level led to extensive inundation along the lake and in the river mouth floodplain and consequently resulting in the shift and expansion of once narrow papyrus vegetation to extend into a landward direction, forming the current Lake Victoria fringing wetlands. The raging floods resulted in destruction of property, loss of life and the migration of many people to higher areas (Masese *et al*, 2012; Rongoei *et al*, 2013).

Nyando wetland has an average population density of 979 persons per km^2 with a high level of poverty. Between 1989 and 2009, the population growth rate exceeded 3.5%/year, which was above the national average. In addition, cattle population also increased steadily. Due to increase in population and loss of income opportunities, more people have migrated to the wetland area in search of free grazing land and changes in the ecosystem became more pronounced. Demand for water has increased with increase in farming and papyrus harvesting has increased as people discover more uses for the plant for income purposes. This unsustainable harvesting of the papyrus led to the loss of 34 – 50% of the wetland's papyrus between 1969 – 2000. *Phragmites australis* which is mainly used for making fish traps, boats and rafts is also targeted. Other wetland macrophytes threatened by overexploitation include *Sesbania sesban* and *Pycreus nitidus* which are mostly used as building materials (Masese *et al*, 2012; MEMR, 2012; Rongoei *et al*, 2013).

Fishermen burn the wetland to expose aestivating *Protopterus sp.* and to hunt for the Sitatunga in dense papyrus areas. The current fishing practices involve clearing of the wetland to catch fish migrating upstream to spawn. Juvenile fish, especially *Clarias spp*., are also targeted for use as bait for the Nile Perch fishery in the lake. This has resulted in decreased recruitment among most migratory fish species that include *Schilbe mystus*, *Mormyus kannume, Clarias gariepinus*, *Labeo victorianus, Barbus altinialis.* Other fish species that have been lost to the Nyando wetland are *Bagrus bajad, B.docmac, Brycinus sadleri, Brycinus jacksonii* and *Mastercembelus frenatus.* In the past people depended more on fishing as a source of food and income. The community lost income from fisheries due to deterioration of water quality and the spread of water hyacinth in the lake (Masese *et al*, 2012). The pressures on the Nyando wetland include inappropriate land use and

overutilization; conversion of wetlands to agricultural land; unsustainable exploitation of resources; land subdivision and fragmentation. These pressures result in the following impacts: pollution; loss of land cover; introduction of invasive species; reduced water quantity and quality; loss of biodiversity; flooding; reduced fisheries (MEMR, 2012).

2.2.5 Sudd Wetlands

The Sudd wetlands are located in South Sudan, formed by the White Nile's Baḥr el Jebel section. The wetlands derive their name from the Arabic for 'blockage', this refers to the barriers formed by the floating papyrus (Green & El-Moghraby, 2009). There are approximately 30,000 km^2 permanent and 100,000 km^2 seasonally flooded swamps in the Sudd, making it one of the world's largest wetlands and the largest freshwater wetland in the Nile basin. The Bahr-el-Jebel system, originating in the African Lakes Plateau, consists of two main rivers, the Bahr-el-Jebel, the main course of the White Nile, to the west and the smaller Bahr-ez-Zeraf to the east. The Bahr el Jebel flows in a braided channel and the Bahr el Zeraf rapidly and permanently separates it. Lake Ambadi and Lake No are the largest lakes found along the swamps and are near the junction of the Bahr el Jebel with a tributary from the west, namely the Bahr el Ghazal. The area is extremely flat with an average slope of only 10 cm per km (BirdLife International, 2019; Green & El-Moghraby, 2009; Rebelo & El-Moghraby, 2016).

Average annual rainfall is approximately 900 mm and falls from late April to December (BirdLife International, 2019). During periods of high flood and rainfall (e.g., 1917–1918, 1932–1933, 1961–1964, and 1988–1989), the floodplain remains flooded well into the dry season. In contrast, during periods of low flood and rainfall (e.g., 1921, 1923, and 1984), the floodplain "shrinks" and the permanent swamps dry up. Long-term variations in the amount of water discharged from the East African lakes are the main source of changes in the system with impacts on habitats and plant composition in the channels, lagoons, and seasonal floodplain areas (Rebelo & El-Moghraby, 2016). High river flows from the East African lakes occur in the rainy season with peak flows occurring in August to September. About 50 % of the 33 × 109 m3 of water that flows into the Sudd circulates within the ecosystem and does not contribute to the outflow at Lake No. The volume of discharge of the Bahr el Jebel at its confluence with the Bahr el Ghazal at Lake No is calculated as 16 × 109 m3 as steady outflow over the year (Rebelo & El-Moghraby, 2016). In 2006 the permanent swamps that extend from Bor to Lake No and are approximately 57,000km2 in size were designated a Ramsar site (Ramsar).

The Jonglei Canal is a canal project that was first proposed in 1907 to divert water from the Sudd so as to deliver more water downstream to Sudan and Egypt for use in agriculture. The proposal is to construct a canal east of the Sudd which would divert water from the Bahr el Jebel above the Sudd to a point farther down the White Nile, bypassing the swamps and carrying the White Nile's waters directly to the main channel of the river. The canal is to reduce the huge loss of water to evaporation in the Sudd swamps, thereby gaining about 4.7 × 109 m^3 of water for downstream use, as well as to reclaim approximately 1,000 km^2 of agricultural land. The Sudd area loses about 51% of the water that enters it from Bahr el Jebel and almost all the water of Bahr el Ghazal through evapotranspiration. Construction started in 1978 but was halted in 1984 due to the civil war. Due to the independence of South Sudan in 2011, there is no current agreement to resume the project (Dumont, 2009; Ramsar; Wikipedia).

The Sudd is composed of a maze of wetland ecosystems, grading from open water and submerged vegetation to floating fringe vegetation, seasonally inundated woodlands, rain-fed and river-fed grasslands, and floodplain scrubland. There are three swamp types: *Vossia cuspidata* swamps (which cover 250 km²), *Cyperus papyrus* swamps (3,900 km²) and *Typha domingensis* swamps (13,600 km²). Grassland can be divided into seasonally river-flooded grassland (16,200 km²) and seasonally rain-flooded grassland (20,000 km²). There are areas of single-species woodland mainly of *Acacia seyal* (5,400 km²) or *Balanites aegyptiaca* (5,300 km²). Mixed woodland is characterized by *Ziziphus mauritiana*, *Combretum fragrans*, *Acacia seyal* and *Balanites aegyptiaca*. In the permanent swamps, the channels have a band of *Vossia*, backed by *Cyperus papyrus*, usually forming a floating mat, which is backed by *Typhia domingensis*. Since 1950, *Eichhornia crassipes* has started to replace *Pistia stratiotes*, the Nile Cabbage. The native free-floating water cabbage has been pushed out and had become confined to temporary pools and small khors. The tall plants provide a framework for climbers such as *Luffa cylindrical* and *Vigna luteola*. In some areas

the papyrus is replaced by *Phragmites karka*, which does not form a floating platform. Further away from the main channels there are swamps dominated by *Typha domingensis* (BirdLife International, 2019; Green & El-Moghraby, 2009). At times *Eichhornia crassipes* (Nile hyacinth) causes blockages along the White Nile from the Sudd to Jebel Aulia dam (Green & El-Moghraby, 2009). Seasonal flooding enables the growth of grasses such as *Sorghum sudanica, Echinochloa spp.* and *Oryza longistaminata,* wild rice-grass*.* This grassland is known as the 'toich'. Where the water is deeper the *Oryza longistaminata* is dominant, but needs several months (mostly up to 3) of surface water in order to flower. *Echinochloa pyramidalis* is the dominant grass with *Sporobolus pyramidalis*, *Digitaria debilis* and *Desmodium hirtum* where the flood water is shallower. The pools formed by seasonal flooding have their own separate vegetation with *Echinochloa stagnina, Glinus lotoides, Sesbania rostrate* and *Aeschynomene indica.* It is the most productive grassland type in terms of year-round grazing for livestock and wildlife due to the high protein content of dead materials of wild rice grass. Within the toich there are many small seasonally flooded pools that are sources of water for domestic, livestock, and wildlife use as well as fish. Further from the channels, where rain is the main source of water, *Hyparrhenia rufa* is the main grass or *Sporobolus pyramidalis. Echinochloa haploclada* occurs where the soil is better drained and is heavily grazed by livestock. The grasslands merge into open floodplain woodland with *Acacia seyal, A. sieberiana* and *Balanites aegyptiacus* (Green & El-Moghraby, 2009; Rebelo & El-Moghraby, 2016). Aquatic macrophytes provide shelter, food, hatching and nesting sites for other organisms. They play an important role in the gaseous balance in both the atmosphere and hydrosphere. *Suddia sagitifolia*, is the single higher plant presumed endemic to the Sudd. It is rhizomatous, with nodal rooting, reaches a height of 2.5 m and grows within papyrus swamp. Its enormous, 12 cm wide leaves are well adapted to function in the shade of reed swamps (Osman, 2009).

The Sudd supports high levels of biodiversity and several endangered animal species are found in the Sudd namely, A*cinonyx jubatus* (cheetah), *Addax nasomaculatus (*White addax),*Equus grevyi* (Grévy's zebra), various gazelles (*Gazella dama*, *G. dorcas*, *G. leptoceros*, *G. rufifrons*, *G. soemmerringii*), *Kobus megaceros* (Nile lechwe), and *Lycaon pictus* (African wild dog). Other swamp dwelling mammals include *Hippopotamus amphibius* (hippoptamus), *Tragelaphus spekeii* (Sitatunga), *Atilax paludinosus* (Marsh Mongoose). *Kobus megaceros* (Nile Lechwe) is endemic to the Sudd and its movements are related to the flood cycle. It does not live in the swamp but follows the waterline of the river flooded grasslands. *Kobus kob leucotis* (White-eared Kob) make large migrations in the seasonal grasslands, they feed in the grasslands mainly on *Hyparrhenia* and associated grasses. *Loxodonta africana* (elephant) make local movements in the wetlands as the water recedes and giraffes have been seen wading in the water. Migratory mammals depend on the wetland for their dry season grazing (BirdLife International, 2019; Green & El-Moghraby, 2009; Ramsar 2; Rebelo & El-Moghraby, 2016). Located on the eastern flyway between Africa and Europe/Asia, the Sudd is one of the most important wintering grounds in Africa for Palaearctic migrants, providing essential habitats for millions of migrating birds such as *Pelecanus onocrotalus, Balearica pavonina, Ciconia ciconia* and *Chlidonias nigra*. *Balaeniceps rex* (Shoebill) is considered as an icon of the Sudd. The Shoebill avoids the main channels of the swamp and very tall vegetation. The Shoebill prefers the smaller channels and pools specifically those surrounded by *Typha*. It mostly eats air-breathing fish which the Shoebill ambushes when they come up for air. (BirdLife International, 2019; Green & El-Moghraby, 2009; Rebelo & El-Moghraby, 2016).

Hydrologically the Sudd wetland is regarded as a giant filter that controls and normalizes water quality and a giant sponge that stabilizes water flow. It is the major source of water for domestic, livestock and wildlife use, and an important source of fish. The people living within and adjacent to the Sudd region are almost exclusively Dinka, Nuer and Shilluk. The socio-economic and cultural activities of these Nilotes are entirely dependent on the Sudd wetland and on its annual floods and rains to regenerate floodplain grasses to feed their cattle. They move from their permanent settlements on the highlands to dry season grazing in the intermediate lands (toich) at the beginning of the dry season and return to the highlands in May-June when the rainy season starts. Threats to the site include oil exploration – Sudd contains Sudan's largest oil block – and the Jonglei Canal Project, which is currently on hold, but would reduce wet and dry season flows by 20 and 10% respectively, thus impacting the wetland's ecology and consequently its inhabitants. (Ramsar)

The Sudd provides a wealth of plants for local residents:

- *Cyperus papyrus* - Local inhabitants cut the tall stems for use as mats and roofing material. Animals graze on its umbels.
- *Phragmites karika* - Culms are used as building material and in mat making.
- *Phragmites sp*. and *Typha sp*. - Major components in phytoremediation, to purify oil contaminated water.
- *Azolla nilotica* - Usually hosts the blue-green, N-fixing Anabaena azolli.
- *Borassus aethiopium* - Fishing boats are made from the tree timber. Fruits are edible.
- *Hyphaene thebaica* - Trunks are used as building material. Fruits are edible.
- *Eichhornia crassipes* - Grazed by animals, used as mulch and fertilizer and for the generation of biogas.
- *Trapa natans* - The fruit is rich in starch and fat. Used as food.
- *Nymphaea spp*. - Rhizomes and fruits are used as food by Nilotic tribes.
- *Aeschynomene indica* - Raft making.
- *Oryza spp*. - Potential rice crop. (Osman, 2009).

The permanent and seasonal aquatic systems of the Sudd wetland play important roles in the life-cycles of many fish species found in the Sudd. The different habitat types ranging from open water, riverine, lacustrine to palustrine provide for the complete life cycle of the fish (Ramsar). Important fish species from the seasonal floodplain habitat are facultative air breathers e.g. *Protopterus aethiopicus, Polypterus senegalus, Heterotis niloticus, Xenomystis nigri, Clarias gariepinus, Ctenopoma murie*i, and *Parachanna obscura*. The important species in the lakes and channels of the perennial wetland are *Synodontis schall, S. frontosus* and *Auchenoglanis biscutatis, Alestes dentex* and *Heterotis niloticus* (Witte *et al.*, 2009).

The Sudd swamps produced about 30,000 t of fish in 2003. The potential yield of this wetland with a surface of 30,000–40,000 km^2 has been estimated at 75,000 t y−1. The prevailing fishing techniques are hook and line, long lines, gill nets, seine nets, cast nets, traps, and spear fishing. However, the mesh size of the monofilament gill nets are becoming smaller and the twine thinner (Witte *et al.*, 2009).
The Sudd provides many ecosystem services and has a profound effect on water quality, nutrient retention, and river hydrology. In addition, it provides extensive economic and environmental benefits to the entire region; the socioeconomic benefits of the wetland to the communities living in its catchment are immense. It is estimated that over one million people are almost entirely dependent on the wetland, their way of life inextricably tied to the seasonal expanding and shrinking of the swamps and the changing depth of water. The channels of the wetland are used for navigation by both commercial and public steamers as well as boats and canoes. The wetland is a major source of water for domestic use and provides building materials for the local communities. An important source of fish, it is one of the only water bodies of the Nile which is not currently overfished. Due to the lack of processing and storage facilities, commercial fisheries are yet to be exploited (Rebelo & El-Moghraby, 2016).
The Sudd provides a source of water and essential dry-season grazing land for livestock, the backbone of the Nilotes' economy. Most of the tribes living within the Sudd catchment are nomadic and move with their large herds of cattle in response to the annual regime of the Bahr el Jebel and rainfall. Fishing is the second most important occupation of the inhabitants of the wetlands especially the Shilluk and Nuer. Subsistence hunting is also important to the Nilotes of the Sudd catchment. Crop production is not a significant occupation although some subsistence agriculture is carried out in the highland areas during the wet season. The agricultural potential of the area is limited by the vagaries of the climate, pests, weeds, and diseases (Rebelo & El-Moghraby, 2016).
The Sudd has very high cultural values for the Dinka, Nuer, and Shilluk communities. During periods of low flow, the wetland is a social centre for the initiation of relationships and dancing leading to courtship and marriage. The wetland sustains the livestock used as dowries for marriages, religious rituals, and payment of penalties. In addition, the wetland contains various wildlife species considered to be sacred by the Nilotes. These include the Nile lechwe, Shoebill, and the crowned crane (Rebelo & El-Moghraby, 2016).

2.2.6 Semliki Wetlands

The Semliki Wetlands include Lakes Albert, George and Edward. The Semliki River is the largest river in the Lake Albert Wetland basin, providing drainage from the Ruwenzori Range and is a major contributor to Lake Albert. The river originates in Lake Edward, flows for 230 km and discharges into Lake Albert at its southern end. Lake Edward is connected to Lake George on its north eastern side by the Kazinga Channel. The Semliki Wetlands have both natural lakes and lacustrine swamps, and riverine and floodplain wetlands (Green, 2009; Uganda, 2016).

The areas drained by the Semliki River are among those with the highest floral and faunal diversity in Africa, with bird species being especially diverse. The river flows through the Parc National des Virunga in DR Congo, and borders the Semliki National Park in Uganda and is home to a wide range of wildlife, including *Loxodonta africana (*elephant), *Hippopotamus amphibious* (hippopotamus), *Crocodilus nilotics* (Nile crocodile), and various kinds of antelopes. Due to the hilly nature of some of the land drained by the river, intense seasonal rains and increasing human activity on the mountain slopes, the loads of silt in the Semliki river are increasing leading to frequent course changes and hence shifts in the international border with potential for conflict between DR Congo and Uganda (NBI, 2019). The Semliki River is highly erosive and in sections annually undercuts approximately 10 m of the river bank on the Ugandan side and silt from the Semliki is gradually filling in the southern end of Lake Albert (Uganda, 2016).

The Lake Albert Wetland Basin is 18,037 km^2 and is on the border of Uganda and the Democratic Republic of Congo. Lake Albert lies along the Rift Valley which forms steep sides along the lake. The basin is classified as an Important Bird Area, Ecoregion by World Wildlife Fund for Nature and a Biodiversity Hotspot by Conservation International (Green, 2009; Uganda, 2016). Lake Kyoga discharges into Lake Albert, where large seasonal wetlands are found. Smaller seasonal wetlands are found along the banks of the Nile from Lake Albert to the border with Sudan. Lake Albert is an important link between the White Nile and its headwaters; without the flow regulation of this lake the White Nile would be reduced to a seasonal stream and could play no significant role in maintaining the base flow of the main Nile. Lake Albert is approximately 160 km long, 30 km wide and 51m (Rebelo & McCartney, 2012).

The Lake Edward wetland area is 7 130 km^2 and occurs on the western side of the Congo Deep Escarpment and its major contributors are the Rutshuru River and the Kazinga Channel. The Nyamugasani River also drains into Lake Edward, and the rivers of Butawu and Lamya join Lake Edward's outflow, the Semliki River, on route to Lake Albert (Eggermont *et al*, 2009). Lake Edward is 2 325 km^2 and the deepest part is 112 m. The wetlands surrounding Lake Edward form a buffer to the heavy runoff from the surrounding hills (Uganda, 2016; Witte *et al*, 2009).

The Lake George wetland area is 150 km^2 of permanent freshwater lakes (Rebelo & McCartney, 2012). The lake's inflows are the streams of the Rwenzori Mountains and the rivers of Nyamwamba, Mubuku, and Ruimi. The lake's outflow is south through the Kazinga Channel (Eggermont *et al*, 2009). Lake George is a small (270 km^2) shallow lake with the average depth of 2.4 m. Lake George is a designated Ramsar site (Uganda, 2016; Witte *et al*, 2009). The Kazinga Channel connecting Lakes George and Edward is a natural channel, 915 m wide and 32 km long. It occurs within the Queen Elizabeth National Park. The channel has a large concentration of hippopotamus and Nile crocodiles. The Queen Elizabeth National Park also has *Syncerus caffer* (buffalo), *Kobus kob thomasi* (Uganda kob), *Loxodonta africana* (elephant), *Panthera pardus pardus* (leopard), *Panthera leo* (lion) and *Pan troglodytes* (chimpanzee) (Uganda, 2016; Witte *et al*, 2009). Lake George has 3 different swamp types of vegetation (Ramsar). As an Important Bird Area, it provides overwintering for Palearctic waterbirds and over 600 species of birds have been recorded. Eleven species of global conservation concern have been recorded and the endangered *Torgos tracheliotus* is a breeding resident (BirdLife, 2019). The Papyrus swamps of Lakes Edward and George are considered to be biodiversity hotspots due to the high percentage of endemic species, globally important species and threatened species. One such contributing species is the endemic papyrus, *hioropetagracilirosiris.* Lake George also has a very high concentration of endemic cichlid fish species (USAID, 2015).

The Semliki River enters Lake Albert through a delta densely overgrown with *Aeschynomene elaphroxylon* and *Cyperus papyrus*. The convergence between Lake Albert and the delta forms a shallow area that is important for waterbirds, especially the Shoebill, Pelicans, Darters and various heron species. In addition, the delta is an important spawning and breeding ground for fish. The higher and wetter areas to the south and east of the lake, forms a feeding and watering refuge for wildlife in the National Park during dry seasons (Ramsar). Important commercial fish species caught in Lakes Albert, Edward and George include: *Oreochromis niloticus*; *Clarias gariepinus*; *Bagrus docmak*; *Protopterus aethiopicus*. Only *Neobola bredoi*, *Lates niloticus* and *L. macrophthalmus* are found in Lake Albert. Fishing numbers have declined over the last few years, some of which is attributed to overfishing and water pollution through degradation of the lakes' shoreline, siltation of wetlands, use of agro-chemicals, industrialization and urbanization around the lakes and alteration of fish habitat (NEMA, 2014). Lakes Edward and George are isolated from Lake Albert by falls in the Semliki River, which are supposed to form a barrier to most fish species migrating upriver (Greenwood, 1976). *Lates niloticus* (Nile perch) occurs naturally in Lake Albert, but was stopped from migrating upstream by these falls. In Lake Albert, the Nile perch has a natural predator in large crocodiles. Two species of snakes found in Lake Albert, *Grayia smythii* and *Naja melanoleuca* are known to feed on fish (Dumont, 2009).
An increase in the population and resultant activities around the lakes may cause a threat to the wellbeing of the lakes. The demand for firewood, building poles and forest resources has resulted in a loss of tree cover and degradation of the catchment areas. In addition, oil and gas exploration and other infrastructure development may cause an impact on the lakes (Uganda, 2016; Wandera & Balirwa, 2010). The Semliki wetlands offer flood control, erosion control, ground water re-charge, source of water for consumption and water purification. Supporting services offered by the wetlands include pollination, primary production, soil formation and habitat function to aquatic flora and fauna. The wetlands are a source of raw materials for handicrafts, building and fuel. They are used for cultural and spiritual purposes.

2.2.7 Lake Kyoga Wetlands

Lake Kyoga is a shallow, large lake surrounded by wetlands and lakes to the east. The maximum depth of Lake Kyoga is 5.7 m and most of the lake is less than 3 m deep. Kyoga is a natural lake with lacustrine swamp wetlands approximately 1,720 km^2. The eastern end inflows are from Mount Elgon and the northern province of Uganda, Karamoja. The western part of the lake receives the main inflow from Lake Victoria, via the Victoria Nile. The outflow, Kyoga Nile, falls over 400 m before joining the outflow from Lake Albert (Dumont, 2009; Green, 2009; NEMA, 2008; Rebelo & McCartney, 2012). The mean annual rainfall for Lake Kyoga is recorded as 1,294 mm. There are two rainfall seasons, with the higher rainfall occurring in the first season of October to December. The second season occurs between March and May (Brown & Sutcliffe, 2013).

The vegetation of Kyoga is complex with a fringe of *Cyperus papyrus* (papyrus) which also occurs as floating islands and areas where the water is less than 3m deep are covered by *Nymphea spp*. During periods of low water, the lake splits into a series of satellite lakes with swamps of papyrus forming barriers between them when water levels rise again. The floating islands break away during windy weather and can drift for considerable distances. *Eichhornia crassipes* (water hyacinth) invaded the lake in approximately 1988 and has influenced the distribution of some of the submerged plants such as *Ceratophyllum* and *Myriophyllum* (Green, 2009; Rebelo & McCartney, 2012).

Lake Kyoga is of international importance with regards to the conservation of endemic wetland species and its high concentration of endemic cichlid fish species. Over 46 fish species are sheltered by Lake Kyoga, along with numerous crocodiles. When fish production declined*, Lates niloticus* (Nile Perch) was introduced. Lake Kyoga satellite lakes are important refuges for the endemic fish species as they have not yet been invaded by the Nile Perch. The water hyacinth can also create areas with water of low oxygen, making it unsuitable for fish like the Nile Perch and only the smaller air breathes, *Protopterus* and *Clarias* are able to survive. The extensive areas covered by the *Nymphaea spp* hamper the setting of fishing nets (Green, 2009; USAID, 2015).

The fauna of Lake Kyoga include *Tragelaphus spekii* (Sitatunga), *Crocidura mourisca* (Northern swamp musk shrew); *Lutra maculicollis (*Spotted-neck otter); *Alilax oaludinosus* (Marsh mongoose); *Cercooithecus aethiops*(vervet monkey); *Hippopotamus amphibius* (hippopotamus); *Pelomy hopkinsi* (Papyrus rat); *Colobus*

*satanas (*Black-and-white Colobus Monkey); *Erythrocebus patas (*Red Hussar Monkey); *Kobus kob (*White-eared kob) *and Ourebia ourebi (*Oribi).

Lake Kyoga wetland system provides an important supply of water for domestic and livestock use to the local population. Fishing was the main livelihood activity in the region until overfishing and changes in the wetlands occurred. Subsistence and small-scale crop production is increasing. Coffee, maize, beans and groundnuts are the main crops. Papyrus is used for making mats and other crafts. The production of charcoal is also a main activity. The silt carried by the river and settling along the river banks is mined by young men. The clay from the lake is used in cultural ceremonies such as circumcision in young men (NEMA, 2008; Rebelo & McCartney, 2012).
The wetland ecosystem services that have been observed are:

- A reduction in flood control, the largest impact was in 1997 when heavy rains occurred due to El Niño. Lake Kyoga levels rose by 2 m causing loss of crops and property along the lake's shores. The rain uprooted the papyrus shores causing it to float on the lake. These uprooted papyruses blocked the outflow into the Kyoga Nile resulting in increased water levels in Lake Kyoga and a subsequent decrease in water flow along the Kyoga Nile. Once the water levels in Lake Kyoga had receded, the papyrus in the outflow area had dried.
- The quality of the water in the lake has decreased. With the increase in surrounding population and livestock using the wetland for water, so more waste is entering the lake. The popular clay from the lake has high retention properties thereby retaining the water pollution.
- Reduction in fish catch size has led to an expansion of agricultural production within the wetlands increasing pollution from sedimentation and agrochemicals (NEMA, 2008).

2.2.8 Bahr el Ghazal Wetlands

The Bahr el Ghazal is translated from the Arabic 'sea of gazelles' and is one of the five tributaries to the Nile River to the west of the Sudd. The Bahr el Ghazal flows west to east and is fed by numerous seasonal tributaries, mostly from the Congo-Sudan side. It drains the hills between Sudan and the Central African Republic. The Bahr el Ghazal joins the Bahr el Jevel at Lake No and part of the Southern Darfur (Durmont, 2009; Green & El-Moghraby, 2009; Hughes & Hughes, 1992; Sutcliffe, 2009). Extensive floodplains are found along the Bahr el Ghazal with wetlands formed by permanent or seasonal rivers, covering an area of 9 000 km^2, with the flora and fauna similar to those of the Sudd. Most of the inflow into the Bahr el Ghazal Basin is evaporated before reaching the Nile (Rebelo & McCartney, 2012). The annual rainfall is between 1 200 – 1 400 mm and occurs March – October (Sutcliffe, 2009).

Lake Ambadi is formed by a widening of the Bahr el Ghazal. It is 10 km long, 1-3 km wide with a maximum depth of 3 m and set in perennial herb swamps. The Bahr el Ghazal is both the in- and outflow in the north and south of this lake. The lake's vegetation consists of *Ceratophyllum demersum*, *Myriophyllum spicatum*, *Najas pectinate* and *Potamogeton pectinatus*. The shoreline vegetation consists of *Vossia cuspidate*, *Echinochloa* and *Eichhornia crassipes* (Hughes & Hughes, 1992). The fringe vegetation is shorter on the Bahr el Ghazal and extensive stands of *Typha domingensis* occur. Species diversity used to be greater and the less turbid waters allowed considerable development of floating-leaved and submerged species. Broad beds of the submerged vegetation dominated by *Najas pectinata* and *Potamogeton schweinfurthii* occur. In shallow water zones of *Nymphaea lotus* and *Trapa natans* occur. Of interest the *Eichhornia crassipes* found in the Bahr el Ghazal have a decreased shoot length and increased root length and thus appear stunted (Denny, 1984). *Khaya senegalensis* and *K. grandiflora* form part of the plantations along the Bahr el Ghazal (ME, 2015).

The bird checklist for Bahr el Ghazal includes vulnerable, threatened and endangered species. Some of these birds are: *Neophron percnopterus,* (Egyptian Vulture), Endangered; *Torgos tracheliotos,* (Lappet-faced Vulture), Endangered; *Aythya ferina,* (Common Pochard), Vulnerable; *Streptopelia turtur,* (European Turtle-Dove), Vulnerable; *Balearica pavonina,* (Black Crowned-Crane), Vulnerable; *Balaeniceps rex,* (Shoebill), Vulnerable; *Bucorvus abyssinicus,* (Abyssinian Ground-Hornbill), Vulnerable; *Ardeotis arabs,* (Arabian Bustard), Near-threatened; *Numenius arquata,* (Eurasian Curlew), Near-threatened (avibase). The Shoebill is

easier to spot in the swamps of Bahr el Ghazal as the papyrus is not as dense as in other places (Swamps) of the Upper Nile (Green & El-Moghraby, 2009).

Some of the mammal species found within the Bahr el Ghazal include: *Tragelaphus spekii* (Sitatunga), *Colobus guereza* (Black-and-white Colobus monkey), *Comopithecus hamadryas* (Hamadryas baboon), *Damaliscus corrigumtiang* (Tiang antelope), *Kobus ellipsiprymnus defassa* (Defassa Waterbuck), *Lutra maculicollis nilotica* (Web-footed otter), *Lycaon pictus* (Cape Hunting Dog) and the endemic *Ontragus megaceros* (Nile Lechwe).

The fish found in the Bahr el Ghazal generally have a high tolerance to low oxygen. Fish species found include: *Brycinus nurse* (Nurse tetra), *Alestes dentex* (Nile Robber), *Clarias anguillaris, Epiplatys spilargyreius, Labeo coubie, Ctenopoma petherici, Hydrocynus forskahlii, Micralestes acutidens* (Sharptooth tetra), *Mochokus niloticus, Hydrocynus brevis, Labeo niloticus* (Nile carp), *Brycinus macrolepidotus* (Large Scaled Robber).

The ecosystem services provided by the Bahr el Ghazal include:

- source of water for the local population and livestock;
- flood attenuation;
- recharging of groundwater;
- natural filter of water thus improves water quality;
- source of fish;
- source of grazing for livestock (Rebelo & McCartney, 2012).

Pressures from an increasing population on the wetland ecosystems result in degradation through the unsustainable and poorly managed extraction of fish, fresh water, timber, fibre and fuel. Resource overexploitation including overgrazing and the conversion of land for agriculture and settlement increases the effects of climate change on the wetland (Rebelo & McCartney, 2012).

2.2.9 Baro, Akobo and Sobat rivers (Machar Marshes)

The Baro-Akobo wetlands in Ethiopia and the Machar Marshes in Sudan are tributaries of the White Nile. The Baro River only breaks its northern banks and provides water to the Machar Marshes when in peak flow. The rivers Akobo and Sobat are also tributaries to the Machar Marshes. The Machar Marshes are 200 km long and 180 km wide. Should any water from this system be stored or extracted upstream of this overflow, the area of seasonally flooded marshes will be significantly reduced with serious impacts on livestock and wildlife, thus making the Machar Marshes one of the most important wetlands in the Nile Basin (Rebelo & McCartney, 2012; Sutcliffe, 2009).

The seasonal Sobat River flows into the White Nile from the east and is fed by runoff from the southwest Ethiopian mountains. (The White Nile derives its name from the white sediment from the Sobat River.) The rivers Baro, Akobo and Pibor are the Sobat River's main tributaries (Sutcliffe, 2009). The Sobat River flows into Lake No's right bank. When the Sobat River is in flood, the volume of water carried may double in October and November. The Baro River drains the Ethiopian mountains on the eastern side of Gambela. The rivers Gila and Akobo flow into the Pibor River from the mountains south of the Baro River. The Baro Akobo catchment area includes seasonal headwater wetlands (Hughes & Hughes, 1992; Rebelo & McCartney, 2012; Sutcliffe, 2009). These wetlands have a single wet season between May – October, but rain does occur in varying amounts throughout the year (Mahomed, 2016).

The Machar Marshes have three different land covers namely permanent wetlands with deep water bodies; seasonal flood plains inundated due to river spills and rainfall and dry fringes, which include seepage wetlands. The permanent swamps are dominated by *Cyprus papyrus*, *Phragmites* and *Typha* and grassland on the floodplains. *Acacia spp* and scattered shrubs occur on the dry areas of the fringes (Mahomed, 2016; Rebelo & McCartney, 2012). Invasive weeds found in the wetlands are *Mimosa pigra* and *Eichhornia crassipes*. *M. pigra* forms impenetrable thickets thus hindering movement and destroying natural

biodiversity. *Eichhornia crassipes* disrupts hydropower generation, increases siltation and evapotranspiration, reduces fish stock and reduces water quality (Bezabih & Mosissa, 2017).

Some of the mammals occurring in the wetlands include *Hippopotamus amphibious* (hippopottamus), *Tagelaphus spekei* (Sitatunga), endemic *Kobus megaceros* (Nile Lechwe), *Kobus kob leucotis* (White-eared Kob), *Damaliscus lunatus* (Tiang) and *Ourebia ourebi* (Oribi). The Baro River has a high fish species to diversity and contains a mixture of Nilo-sudanic, East African and endemic species. Some of these fish species include *Lates niloticus* (Nile perch); *Clarotes laticeps; Bagrus bajad; Citharinus; Barbus; Sarothrodon; Oreochromis niloticus* (Nile Tilapia); *Protopterus aethiopicus* (Lung Fish). Some of the main commercial species are *Labeo hori*, *Clarias gariepinus*, *Barbus spp*. and *Lates niloticus* (Kebede *et al*, 2017). Flagship bird species for the Baro-Akobo wetland system include *Balaeniceps rex* (Shoebill); *Pelecanus onocrotalus* (Great White Pelican); *Anastomus lamelligerus* (African Openbill); *Scotopelia peli* (Pel's fishing owl); *Aythya nyroca* (Ferruginous Pochard).

Machar Marshes floodplains are used for livestock grazing during the dry season. Hunting and fishing occur within the wetland. The Baro and Akoba wetlands provide a source of water, fish, grazing, an area for cultivation, construction material and medicinal plants. The increased population around the wetlands has resulted in increased loss of wetland due to agriculture and the resultant degradation (Rebelo & McCartney, 2012). The headwater wetlands of the Baro Akobo provide important flow regulation in the Baro Akobo River which plays an important role in maintaining the downstream dry-season river flows. The Machar Marshes play an important hydrological function in the White Nile and its tributaries through reducing flood peaks and supporting dry-season river flows thus reducing the seasonal variation in the flow of the White Nile (Rebelo & McCartney, 2012).

Specific wetland practices which communities have developed, and which have helped achieve sustainable use include:

- only draining part of the wetland,
- never over draining any areas in the wetland,
- use of drain blocking to control water levels,
- protecting springs at the head and outlet of the wetland with natural swamp vegetation (*Cyperus latifolius*),
- maintaining the annual flooding regime through major ditch blocking,
- limiting or banning cattle grazing in wetlands,
- maintaining a well-vegetated catchment – often coffee forest in this area,
- use of local knowledge on how best to use wetlands, and
- recognition of local institutions to manage the use of these areas and facilitate exchange of information to encourage innovation and adaptation of practices.

2.2.10 Lake Tana Wetlands

Lake Tana wetlands occur in the northern highlands of Ethiopia and are the source of the Blue Nile. The wetland area is approximately 3,050 km2 and occurs within the Afro-tropical wetland system. Lake Tana is Ethiopia's largest lake and has a maximum depth of 14 m. The lake contains several minor islands and two major islands formed by volcanic cones. Seven large permanent rivers feed the lake as well as approximately 40 small seasonal rivers. The main tributaries to the lake are the rivers Gilgel, Abbay (Little Nile), Megech, Gumara and Rib. Two of the surrounding wetlands are directly connected to the lake during the wet season, namely the Yiganda and Welala wetlands. The Fidiamba wetland is flooded by out bank flow of the Little Abay River during the wet season, while the Infraunz Wetland is connected to the Infruanz River. These two rivers flow into Lake Tana. Some of the main flood plains surrounding Lake Tana are the Fogera plain in the east, Dembia to the north and Kunzila to the southwest (Hughes & Hughes, 1992; Menbere & Menbere, 2018; Vijverberg, et al 2009).

There is one rain season from May to October with a peak during July and August. In a good rain season, rainfall may reach up to 2,000 mm. During the wet season, the inflowing rivers carry heavy loads of suspended silt into the lake, thus increasing the turbidity of the lake's water. The suspended sediments reduce the below water light intensity and as such the primary production, the basis of the food web (Vijverberg, et al 2009).

Lake Tana wetlands provide habitat for globally threatened and endangered species and as such is a biodiversity hotspot. The Tisisat Falls, approximately 40 m high and 30 km downstream from the Blue Nile outflow, isolate the freshwater fauna from the rest of the Nile. The wetlands are the home of the Fogera cattle which have broad hoofs as an adaption to moving in marshes. The shoreline vegetation on the eastern and southern sides of Lake Tana consists of Cyperus papyrus (papyrus), Typha latifolia (common cattail), Phragmites karka (common reed), Persicaria senegalensis, Vossia spp. (hippo grass), Scirpus spp. (bullrush) and Nymphaea lotus. The submersed macrophytes are Ceratophyllum demersum and Vallisneria spiralis. The invasive Eichhornia crassipes was identified in 2011 in Lake Tana and Azolla and Water Lettuce also occur. The papyrus has dramatically declined in its distribution around the lake with some local extinction due to overexploitation (Degaga, 2018; Menbere & Menbere, 2018; Vijverberg, et al 2009).

Some of the 17 endemic fish species of Lake Tana include Garra regressus, G. tana, Barbus tanapelagius, Afronemacheilus abyssinicus, Labeobarbus intermiduis (Shkil et al., 2017). The main commercial fish species are Lates niloticus, Oreochromis niloticus, Labeo hori, Clarias gariepinus, Barbus sp. Fishing at the mouths of the tributaries while fish migration for spawning occurs is a major threat to these fish (Hughes & Hughes, 1992; McKee, 2007).

Lake Tana is an Important Bird Area and provides nesting, breeding, roosting and feedings sites for globally threatened and migratory birds. A winter bird count for just Lake Tana exceeded 150 000. Some of the important bird species include Bugeranus carunculatus (Wattled crane), Poeniconaias minor (Lesser flamingo), Rougetiusrougetti (Rouget's rail), Circus macrourus (Pallid harrier) and Aquila clanga (Greater spotted eagle) (Menbere & Menbere, 2018). Mammals occurring around Lake Tana include Cercopithecus aethiops (Grivet monkey), Crocuta crocuta (Spotted hyena), Erythrocebus poliophaeus (Blue Nile patas monkey), Eudorcas albonotata (Mongalla gazelle), Genetta (Genet), Hippopotamus amphibius (Hippopotamus), Hystrix cristata (Crested porcupine), Colobus guereza (Black-and-white colobus monkey).

The main threats to Lake Tana and the surrounding wetlands are predominantly anthropogenic in origin. The major anthropogenic activities are farming, leather tanning and processing, intensive grazing, draining of the wetlands, vegetation clearance, water abstraction, waste dumping and eucalyptus plantations. These activities result in amongst others deforestation, erosion, sedimentation, water level reduction, excessive flooding of the wetlands, competition for water resources, pollution of water sources and introduction of alien species (Menbere & Menbere, 2018).
Lake Tana and surrounding wetlands offer the ecosystem services of:

- source of water
- purification of water
- raw materials such as firewood, common reeds (Typha, Phragmites) and papyrus
- hydroelectricity
- medicinal flora and fauna
- transport

When the lake level drops during the dry season, the dry lake area becomes available for agriculture and is used by the farmers to grow crops. The wetlands around the southern Bay of Bahir Dar have water for approximately 4 months and it is the country's largest rice production area. The livelihoods of approximately 3 000 Negada people are totally dependent on the wetland products (Vijverberg, et al 2009).

2.2.11 Dinder Wetlands

The Dinder River is a tributary to the Blue Nile in the lower part of its course in Sudan. The Dinder wetlands or mayas are located in the floodplain between the Dinder and Rahad rivers in Sudan. Maya wetlands are back swamps formed due to the meandering of the river and to the nature of water flow, erosion and deposition processes. They are floodplain wetlands found on both sides of the Dinder River as such a unique feature of the Dinder National Park and one of its three major ecosystems. These Mayas are important wetlands as they are the main source of food and water for wildlife during the dry season from November to June (Hassaballah et al, 2018; Mahgoub & Riak; Nile Eco VWU; Rebelo & McCartney, 2012). The Dinder wetland is classified as seasonal or intermittent freshwater lakes and rivers and covers an area of 10.29 km2 with the Dinder River flowing through the centre (Rebelo & McCartney, 2012).
The rainy season is from May to November with the peak in August. The rainfall varies through the wetland with the northeastern part of the Dinder receiving 600 – 800 mm and an increase occurs towards the southeastern part with 800 – 1000 mm (Nile Eco VWU, 2019). The Dinder has three types of ecosystems namely Mayas, Riverine and Acacia seyal – Balinites. The Riverine forest vegetation is characterised by Acacia sieberiana, Ficus spp., Mimosa pigra, Tamarindus indica, Ziziphus abyssinica and Hypaene thebaica. The Acacia seyal-Balanites aegyptiaca woodlands are also subjected to flooding and are characterised by tall grasses such as Sorghum spp., Brachiaria spp and Combretum spp. The swampy lakes are dominated by Ipomoea aquatica, Echinochloa spp, Leersia hexandra and Nympaea spp. The Mayas are characterised by Hyparrhenia spp., Panicum spp., Themeda triandra, Oryza longistaminata, Sorghum sudanensis and Cynadon dactylon (BirdLife, 2019; Hughes & Hughes, 1992).

Bird flagship species for the Dinder include Spatula querquedula (Garganey), Spatula clypeata (Northern Shoveler), Nettapus auritus (African Pygmy Goose), Glareola nordmanni (Black-winged Pratincole), Balearica pavonina (Black Crowned Crane), Rynchops flavirostris (African Skimmer), Aythya nyroca (Ferruginous Pochard), Pelecanus rufescens (Pink-backed Pelican). The Dinder occurs within the migration route of the African wintering birds. The world's largest population of Numida meleagris (tufted Guinea fowl) occurs with the Dinder (Nile Eco VWU).

Mammal flagship species include Aonyx capensis (African Clawless Otter), Hippopotamus amphibius (hippopotamus), Syncerus caffer (African buffalo), Hyaena hyaena (Striped hyaena).The populations of migrant grazers such as Damaliscus corrigumtiang (Tiang antelope), Hippotragus equinus (Roan antelope), Kobus ellipsiprymnus (Waterbuck) and Redunca arundinum (Southern reedbuck), Redunca arundinum (Southern reedbuck), , are under pressure as land outside the park that they migrate across has been converted to farmland.

There are numerous pressures being exerted on the Dinder wetlands. Traditional cattle herders are being displaced from their traditional grazing lands by the expansion of crop agriculture and growing population around the Dinder National Park. These herders then graze their cattle within the national park despite the risk of having half of their herd confiscated. The causal effect is that overgrazing occurs within the national park and outbreaks of rinderpest particularly among buffaloes and tiang (Mahgoub & Riak; Nile Eco VWU, 2019).

The main crops cultivated in the Dinder area are sorghum, sesame, beans, pumpkins, okra, cucumber, maize and groundnuts. Tree felling for charcoal occurs under permits, however strict control is required. The Mayas provide resources for rope making, bed making, fishing and capturing birds in ponds (Nile Eco VWU).

The ecosystem services provided by the Dinder wetlands include:

- source of water;
- purification of water and silt capturing;
- raw materials;
- refuge for migratory birds;
- fishing;
- areas for crop cultivation (Nile Eco VWU).

Threats to the Dinder wetlands:

- encroachment of local population;
- mixed grazing by herders, cultivation, tree felling, poaching and fire setting reduce the nutritional quality of wildlife forage and thus reduce the biodiversity and functioning of the Dinder ecosystem;
- soil erosion from upstream of the Nile basin and subsequent sedimentation in the downstream area;
- lack of coordination between stakeholders (Mahgoub & Riak; Nile Eco VWU, 2019).

2.2.12 Nile Delta

The Nile Delta extends along the Nile River from the Aswan High Dam, 1 100 km downstream to the mouth of the Nile as it enters the Mediterranean Sea. The Delta is about 175 km long and 260 km wide. Since the construction of the Aswan High Dam, the riverine floodplains and delta are no longer subject to annual flooding, and the iconic *Cyperus papyrus* swamps that used to exist in the wettest areas have largely disappeared. The remaining marshland is associated with lakes and lagoons along the seaward face of the delta. The outer margins of the delta are eroding, and salinity levels of some of the coastal lagoons are rising as their connection to the sea increases. Approximately 84% of the water reaching Aswan comes from the Ethiopian Highlands and 16% from Equatorial East Africa. After the high dam, as the river continues downstream, it receives numerous ephemeral tributaries from the western hills that separate the Nile from the Gulf of Suez. These periodic rivers are dry most of the year, but torrents flow down the water-worn gullies after heavy winter rainstorms in the hills. The Nile River divides into two below Cairo, into western and eastern branches that flow into the sea at Rosetta and Damietta. The main lakes in the delta are El Mannah, El Qatta, Faraontya, Sinnéra, Sanel Hagar and there are two coastal lagoons, Manzala and Miheishar (Dumont, 2009; Hughes & Hughes 1992; Fraser & Keddy, 2005). The rainy season is from November to February with the average rainfall of 100 mm to 200 mm (El-Ghani *et al*, 2011; Hughes & Hughes 1992; Fraser & Keddy, 2005).

Two endemic species to the Delta are Sonchus macrocarpus and Zygophyllum aegyptium. The vegetation around the Delta consists of Phragmites australis, Typha capensis, and Juncus maritimus, with some small sedges. The Manzala lagoon has beds of Ceratophyllum demersum, Potamogeton crispus, and P. pectinatus around the southern shore. Other lake shore species are Najas pectinata, Eichhornia crassipes, Cyperus spp. and Juncus spp. The salt tolerant Halocnemum spp. and Nitraria retusa grow in marshes along the Mediterranean coast. Farther south along the river, dense swamp vegetation grows unchecked without the seasonal fluctuations of the Nile, held back by the Aswan Dam. Phragmites and Typha grow along riverbanks that were previously bare. The islands along the river, especially those found between Luxor and Kom Ombo, have reed swamp vegetation (Hughes & Hughes 1992; Fraser & Keddy, 2005; WWF, 2019).

The Nile Delta is part of one of the world's most important migration routes for birds. Every year, millions of birds pass between Europe and Africa during spring and autumn along the 'eastern African flyway', and the wetland areas of Egypt are important resting sites. Some of the many different species that pass through the Nile Delta include Ciconia ciconia (white stork), Ciconia nigra (black stork), Grus grus (European crane) and Pelecanus onocrotalus (white pelican). Migratory birds of prey include Circaetus gallicus (short-toed eagle), Hieraaetus pennatus (booted eagle), Aquila nipalensis (steppe eagle), Aquila pomarina (lesser spotted eagle), Buteo buteo (steppe buzzard), Pernis apivorus (honey buzzard) and Accipter brevipes (levant sparrowhawk) (Hughes & Hughes 1992; Fraser & Keddy, 2005; WWF, 2019).

Some water birds overwinter in the Delta, and Lake Manzala is the most important site with the world's largest concentrations of Larus minutus (little gull) and Chlidonias hybrida (whiskered tern) thus making it an Important Bird Area. Other water birds include Anas clypeata (shoveler), A. crecca (teal), A. penelope (wigeon), A. querquedula (garganey), Ardea cinerea (grey heron), Aythya ferina (pochard), A. nyroca (ferruginous duck), Charadrius alexandrinus (Kentish plover), and Phalacrocorax carbo (cormorant). The Delta is home to the largest breeding population of Larus genei (slender-billed gull) in the Mediterranean Sea (BirdLife, 2019; Hughes & Hughes 1992; Fraser & Keddy, 2005).

Some of the remaining mammals that have been recorded from the Nile River bank include: *Vulpes vulpes* (Red fox); *Gerbillus andersoni* (Anderson's Gerbil); *Psammomys obesus* (Fat sand rat); *Rousettus aegyptiacus* (Egyptian fruit bat); *Rhinopoma macrophyllum* (Greater mouse-tailed bat); *Arvicanthis niloticus* (Nile or field rat)*;* Felis chaus *(Jungle cat)*; *Crocidura floweri* (Flower's shrew); *Hemiechinus auritus* (Long eared hedgehog); *Acomys cahirinus* (Cairo spiny mouse) (Ahmed, 2010).

Three fish flagship species for the Delta are *Heterobranchus longifilis* (Vundu Catfish); *Anguilla anguilla* (European Eel); *Lates niloticus* (Nile perch). Common fish species caught in the Delta include *Oreochromis niloticus* (Nile tilapia), *O. aureus* (Blue tilapia), *Sarotherodon galilaeus* (Mango tilapia), *Tilapia zilli* and *Clarias gariepinus* (African catfish). Other freshwater fish found in the Delta include *Heterobranchus longifilis* (Vundu Catfish), *Lates niloticus* (Nile perch), *Bagrus bayad* (Bagrid catfish), *Labeo niloticus* (Nile carp), *Barbus prince* (Yellow fish), *B. bynni bynni* (Barbus fish). Fish from the brackish-marine sectors of the Delta include *Mugil cephalus* (Grey mullet), *Liza ramada* (Thinlip grey mullet), *L. salinus* (Saline mullet) and *Anguilla anguilla* (European Eel) (Hamza, 2014).

The Nile Basin's most polluted wetlands are those of the Nile Delta and there are no remaining undisturbed areas of delta habitat. The Delta is Egypt's main source of hydrocarbons and natural gas, and the chemical industries located in the delta are a major source of hazardous waste. The two Aswan Dams have turned the former seasonal floodplains into permanent floodplains enabling year-round cultivation with only fragments of the former wetlands remaining. The best remaining habitat is found in the Lakes El Mannah, El Qatta, Faraontya, Sinnéra, Sanel Hagar and the coastal lagoons of Manzala and Miheishar. A consequence of a lack of seasonal flooding is reductions of siltation, thus farmers now have to use artificial fertilizer as a substitute for the nutrients which no longer reach the floodplain, and salinity and waterlogging problems have developed due to over-irrigation (Hamza, 2014; Hughes & Hughes 1992; Fraser & Keddy, 2005).

There are four major threats to the Nile Delta's remaining habitats and species:

- Salinity may continue to increase in the delta from infiltration by seawaters as the delta face erodes and as erosion opens the existing lagoons to the sea.
- Wetlands and other migrating birds will increasingly be hunted and trapped to provide a food source for local populations, and for sale to other countries (e.g. quail trapping which occurs along the coast).
- Inappropriate siting of wind turbines for electricity generation could cause considerable mortality in migrating birds. (Hughes & Hughes, 1992; WWL, 2019)
- The impact of Aswan Dam on Fisheries which has killed species diversity of Nile Delta, reduced fish species, fish migration and connectivity.

Ecosystem services provided by the Nile Delta:

- Protective sand belt in the delta limiting saline intrusion from the Mediterranean Sea thus protecting both groundwater and freshwater sources; inland freshwater fisheries and cultivated agricultural land.
- Major source of freshwater
- Fishing
- Agricultural land (Rebelo & McCartney, 2012)

3 Species Diversity

"Species diversity is the number of different species that are represented in a given community (a dataset). Species diversity consists of three components: species richness, taxonomic or phylogenetic diversity and species evenness. Species richness is a simple count of species, taxonomic or phylogenetic diversity is the genetic relationship between different groups of species, and species evenness quantifies how equal the abundances of the species are" (Hill, 1973; Tuomisto, 2010). (Try this simple video for some basics: https://study.com/academy/lesson/what-is-species-diversity-definition-importance-examples.html).

3.1 Methods

For each wetland / wetland complex a comprehensive list of species that occur (or have occurred) within the wetland / complex was generated using as much existing information as possible. No new data were collected. There were two main sources of existing species distribution data: 1) all pertinent literature that contained species information with sufficient geographic indication, 2) online distribution and species data such as IUCN (IUCN, 2019) and SANBI (SANBI, 2009). Spatial online searches made use of hand-drawn polygons to approximate wetland delineations and all species information within these areas were utilized.

The lists of species within each wetland include obligate, preferential, facultative, opportunistic and terrestrial species i.e. some species (such as wetland obligates) rely completely on the wetland for their existence while others (such as opportunistic visiting terrestrial species) simply visit wetlands to make use of their resources. These differences were noted by including additional information about each species: Additional information (as illustrated by the blank template shown in Table 3-1), includes the historic presence of species as well as other additional information associated with species status including their threat status (IUCN, Cites), degree of endemism and applicable descriptors such as flagship, umbrella, indicator, keystone and important species (important species includes those alien species that are problematic or have direct impacts), as well as whether species are migratory. These terms have been defined for specific use in this study: refer to glossary of terms or see relevant sections below. Simple lists and pivot tables were then used to describe, summarise and present the data.

Table 3-1. Blank template to show the kinds of information sought for each species with an historic presence within each wetland

Wetland	Group	Absolute Numbers	Relative Number	Descriptor information						
				Threat Status	Endemism	Flagship	Keystone	Indicator	Important (includes alien)	Migratory
Wetland name	All taxa									
	Mammals									
	Birds									
	Reptiles									
	Amphibians									
	Fish									
	Invertebrates									
	Plants									

3.2 Basin Species Richness

Within the Nile River Basin, 3079 taxa were noted to occur (or have occurred) within or utilize wetlands, to greater or lesser degrees. These species/taxa and their presence within wetlands are tabulated in Appendix 1, and summary data are shown in Table 3-2. For the sake of comparison between wetlands a somewhat arbitrary categorisation was made whereby the proportion of taxa within a wetland was expressed as Low, Moderate, High or Very High when compared to the taxa within the entire basin (see Table 3-2). According to this categorisation none of the wetlands display a Low taxon diversity (less than 10% proportional representation), 4 wetlands (Nile Delta, Dinder, Lake Tana and the Machar Marshes) have Moderate taxon richness (between 10 and 20% proportional representation), 5 wetlands (Sudd, Bahr el Ghazal, Lake Kyoga, Kagera and Mara) have High taxon richness (between 20 and 30% proportional representation) and 3 wetlands (Semliki, Lake Victoria and Sio Nzoia Yala Nyando) have Very High taxon richness (greater than 30% proportional representation). In addition, taxon diversity generally increases in a South to North direction, along a rainfall gradient (Figure 3-1). The representation of taxa within different taxa groups is shown in Figure 3-2. Birds and fish dominate the taxa richness, but insects, mammals and plants are also high.

Table 3-2. Absolute number and proportion of species/tax within the Nile River Basin for each wetland / wetland complex

Wetland / Wetland Group	No. Species	Proportion of Species
Nile Delta	580	0.19
Dinder	592	0.19
Lake Tana	521	0.17
Baro/Akobo Sobat Wetlands (Machar Marshes)	598	0.19
Sudd	695	0.23
Bahr el Ghazal	603	0.20
Lake Kyoga	768	0.25
Semliki	1071	0.35
Lake Victoria	1982	0.64
Kagera	754	0.24
Mara	816	0.27
Sio Nzoia Yala Nyando	980	0.32
Total:	**3079**	

LOW	0.00
MODERATE	0.10
HIGH	0.20
VERY HIGH	0.30

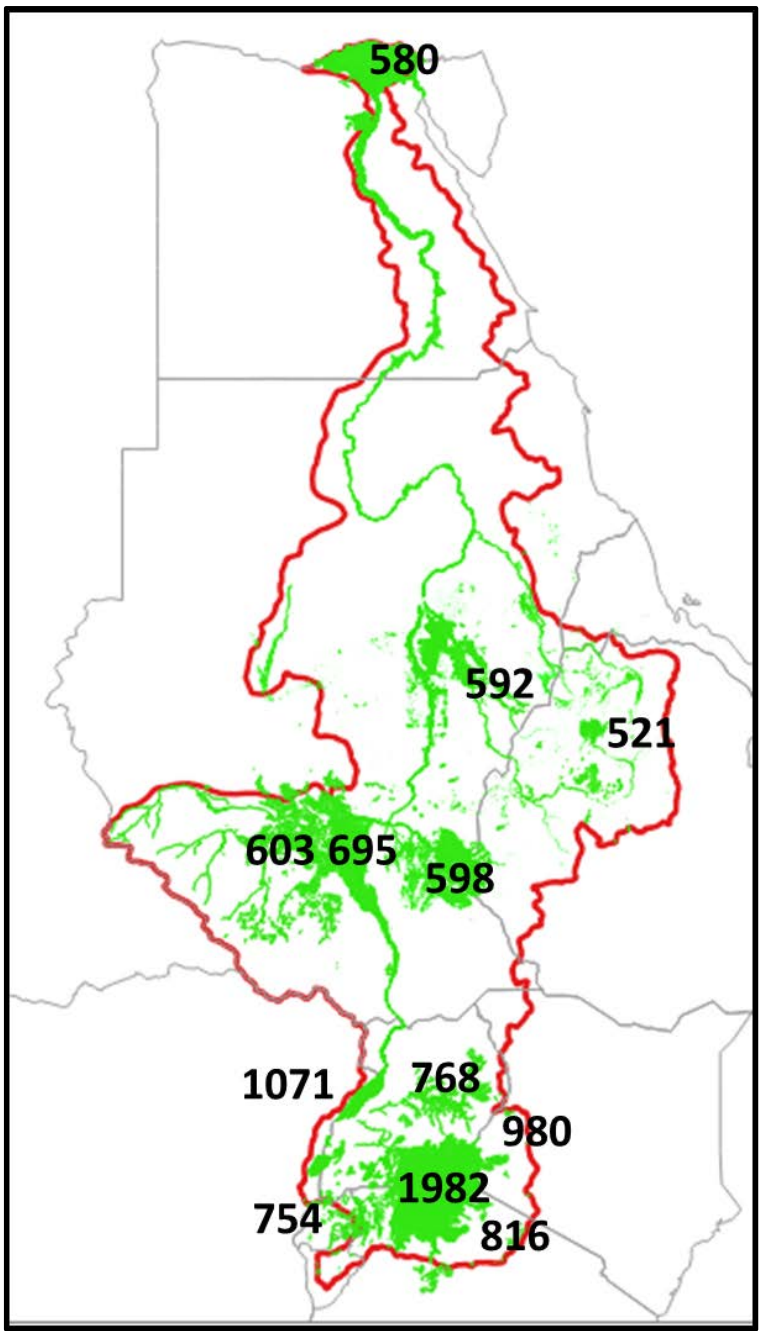


Figure 3-1. Map of the Nile River Basin (red) showing numbers of taxa found within the study wetlands (green)

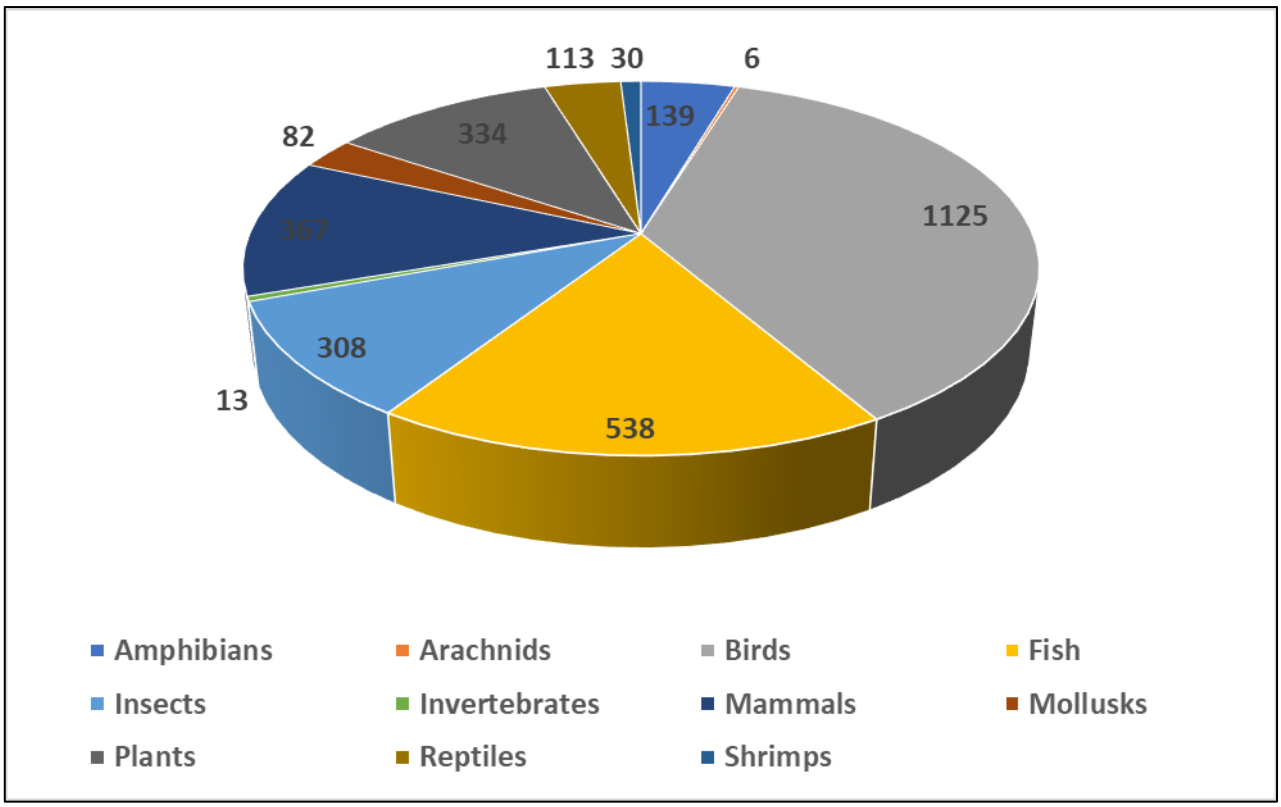


Figure 3-2. Numbers of taxa representing each taxa group within the Nile River Basin

3.3 Species Threat Status

Conservation actions are often based on the location of threatened species and determining the conservation status of species within the integrated assessment study makes their status of interest to this study. The IUCN categorisation of threat was adopted for this assessment (IUCN, 2012; Figure 3-3). The criteria generally considered for the determination of these categories includes population reduction, or a small population that is declining, isolated geographic distribution, or very small and restricted populations. The Extinct (EX), Extinct in the Wild (EW) and Regionally Extinct (RE) categories were ignored for this assessment, as was the category, Data Deficient (DD). The four categories that were foci for this assessment, in order of increasing risk, were Near Threatened (NT), Vulnerable (VU), Endangered (EN) and Critically Endangered (CR). An additional sub-category was also noted: Conservation Dependent are those taxa not necessarily threatened or at risk but only survive under the protection of conservation efforts.

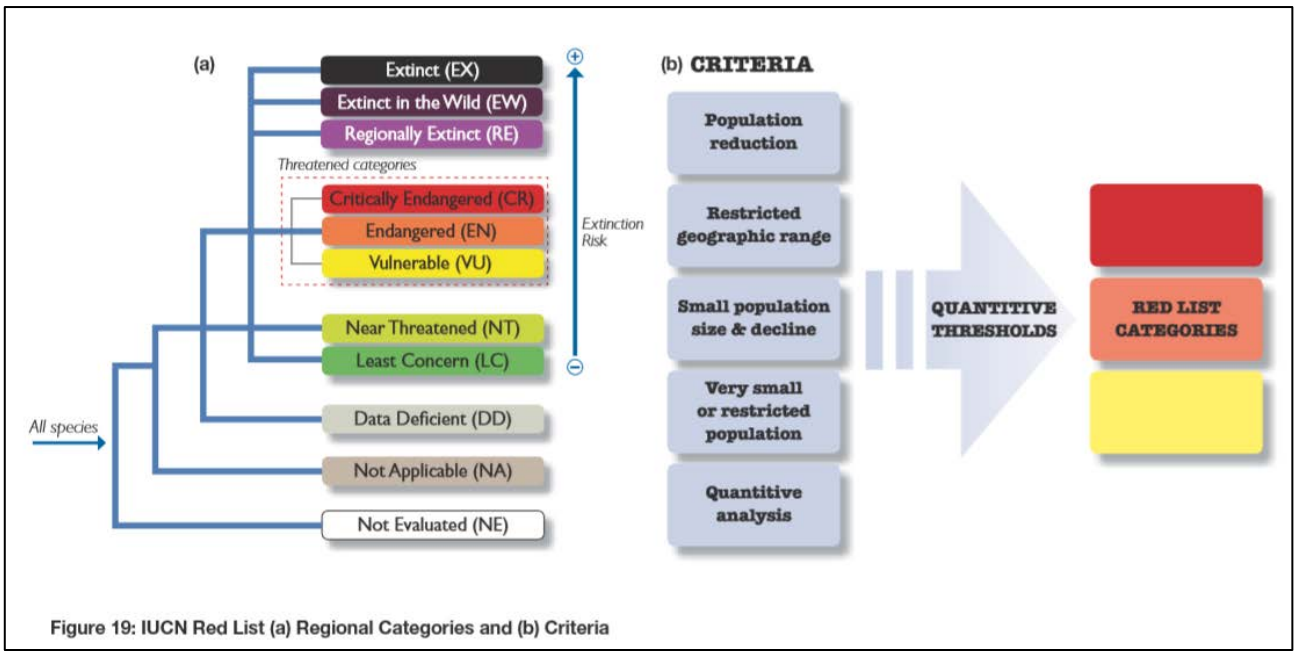


Figure 3-3. IUCN Red List categories and criteria (taken from IUCN, 2012)

The number of distinct taxa with the abovementioned threat status are shown in Appendix 2 for each wetland / wetland complex and taxon group with these wetlands, and summarized in Figure 3-4. All the wetlands have similar numbers of threatened taxa (around 40), except for Lake Victoria and the wetlands that surround the lake (such as Mara and Sio Nzoia Yala Nyando). The Semliki wetlands also stand out and also have lake environments. These higher numbers of threatened taxa are largely comprised of fish species that are at risk. Figures 3.5 to 3.16 show these data graphically.

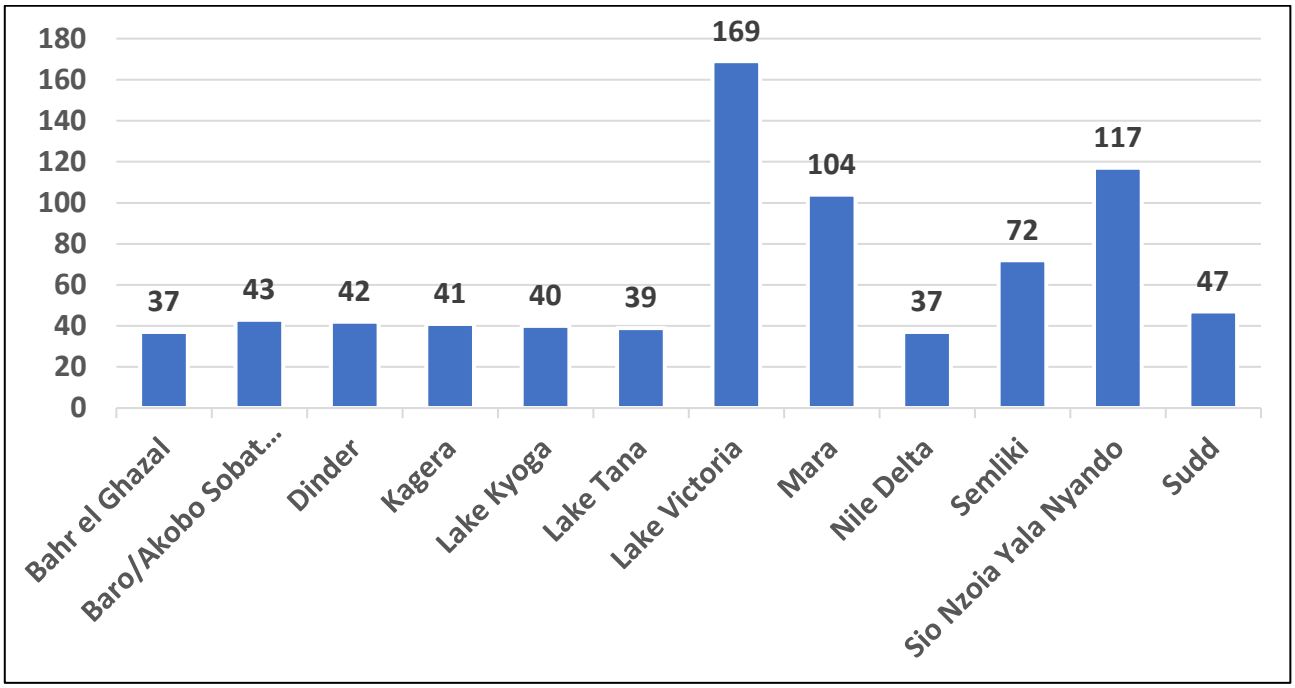


Figure 3-4. Numbers of taxa within each wetland complex that have an IUCN threat status of interest

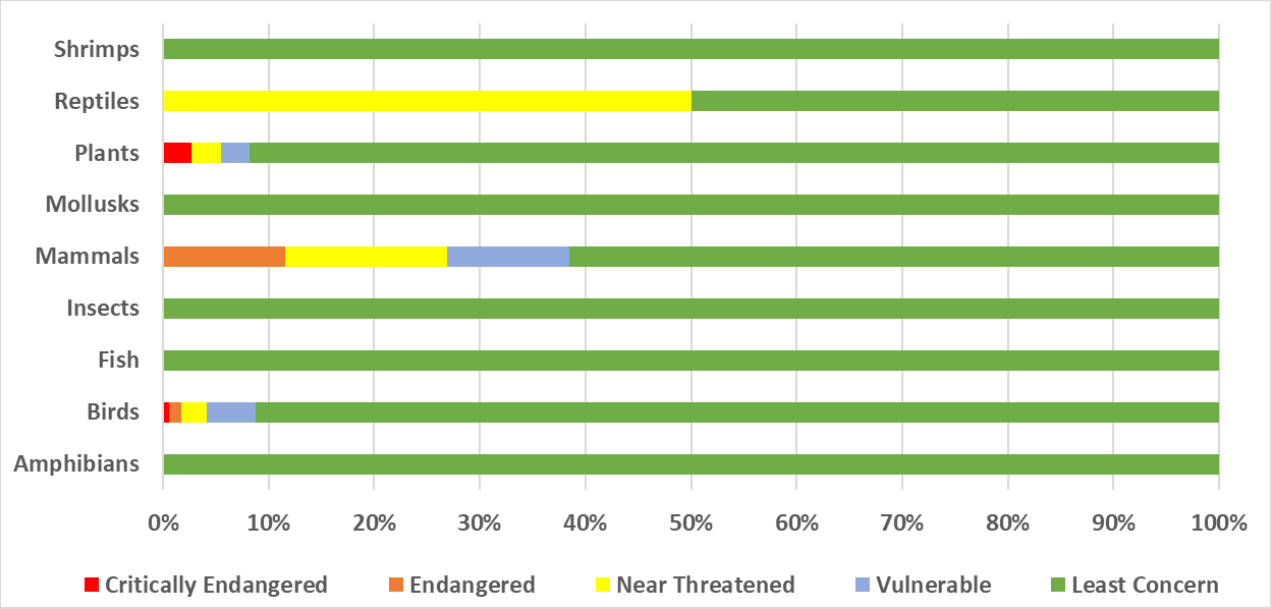


Figure 3-5. Proportion of threatened taxa for the Bahr el Ghazal wetlands

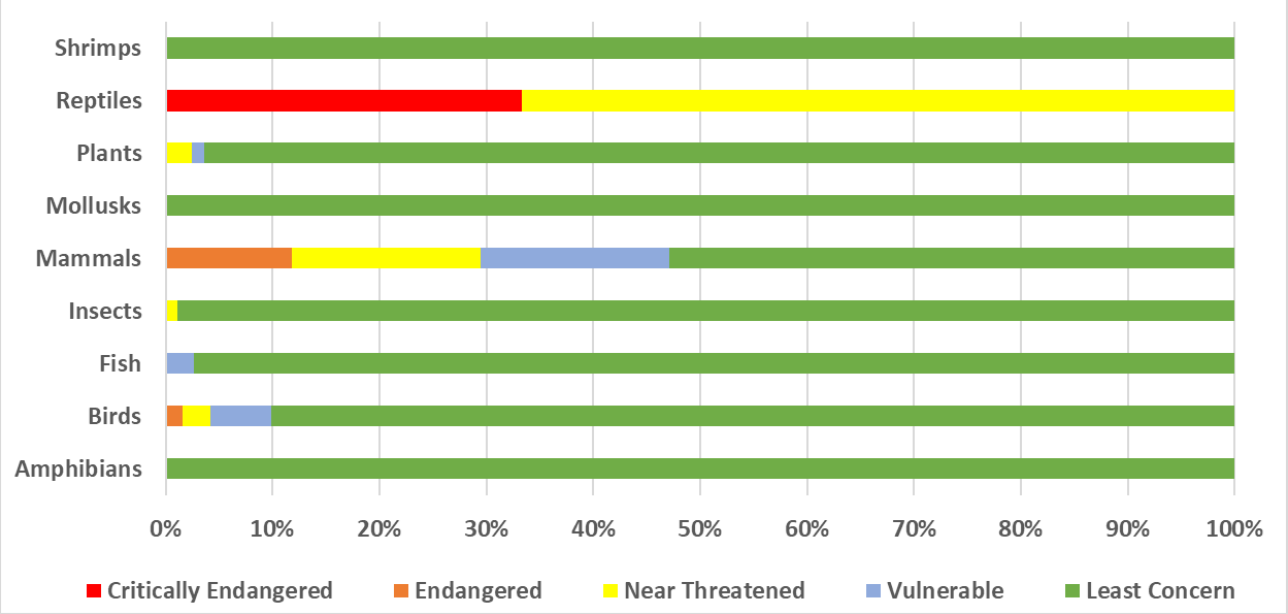


Figure 3-6. Proportion of threatened taxa for the Machar Marshes

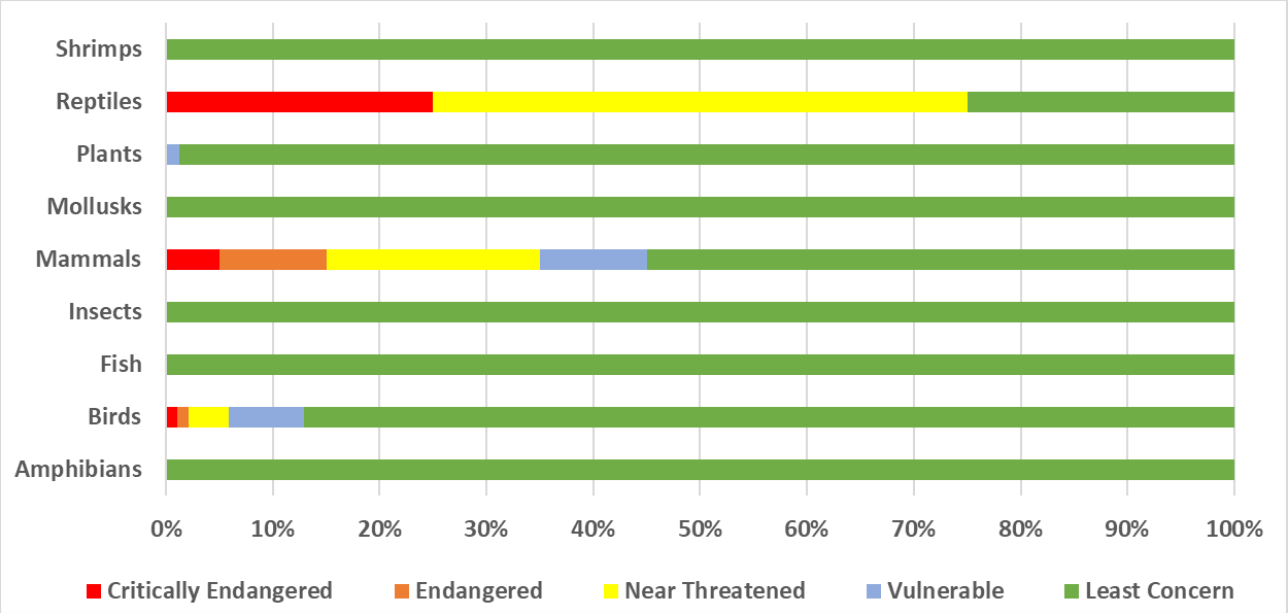


Figure 3-7. Proportion of threatened taxa for the Dinder wetlands

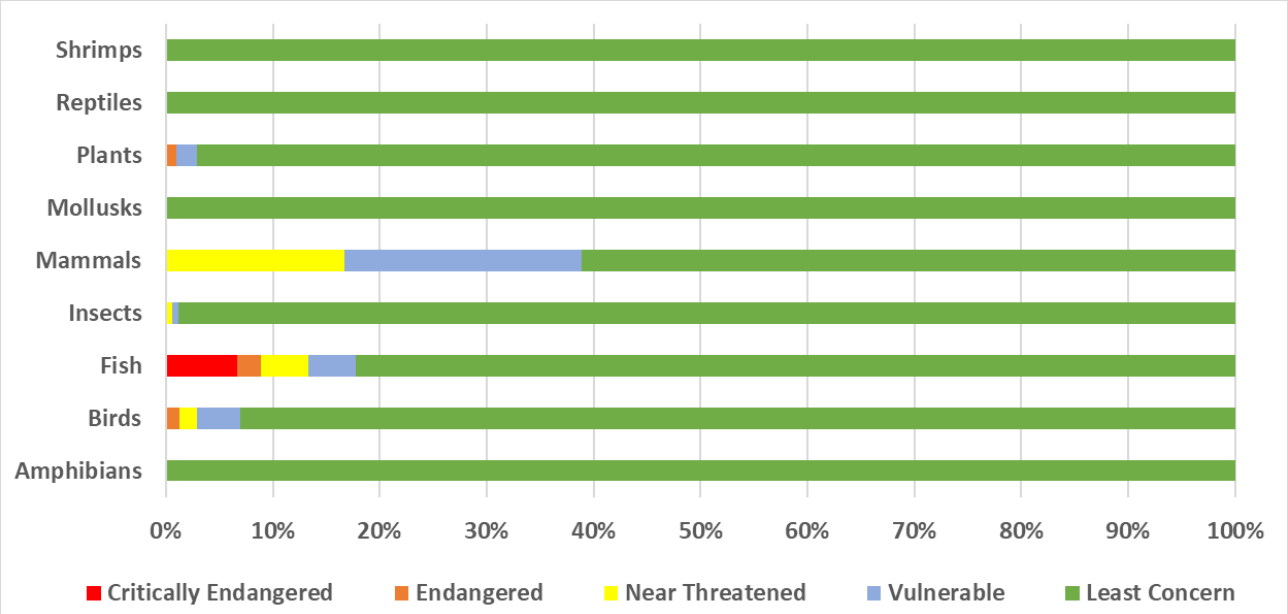


Figure 3-8. Proportion of threatened taxa for the Kagera wetlands

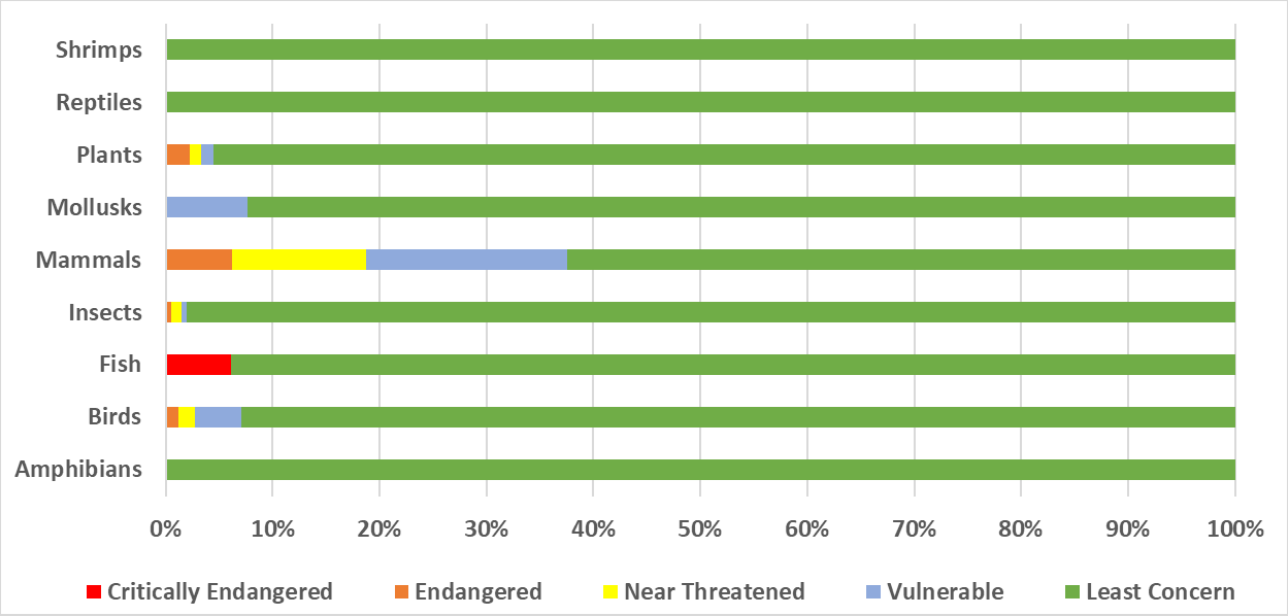


Figure 3-9. Proportion of threatened taxa for Lake Kyoga

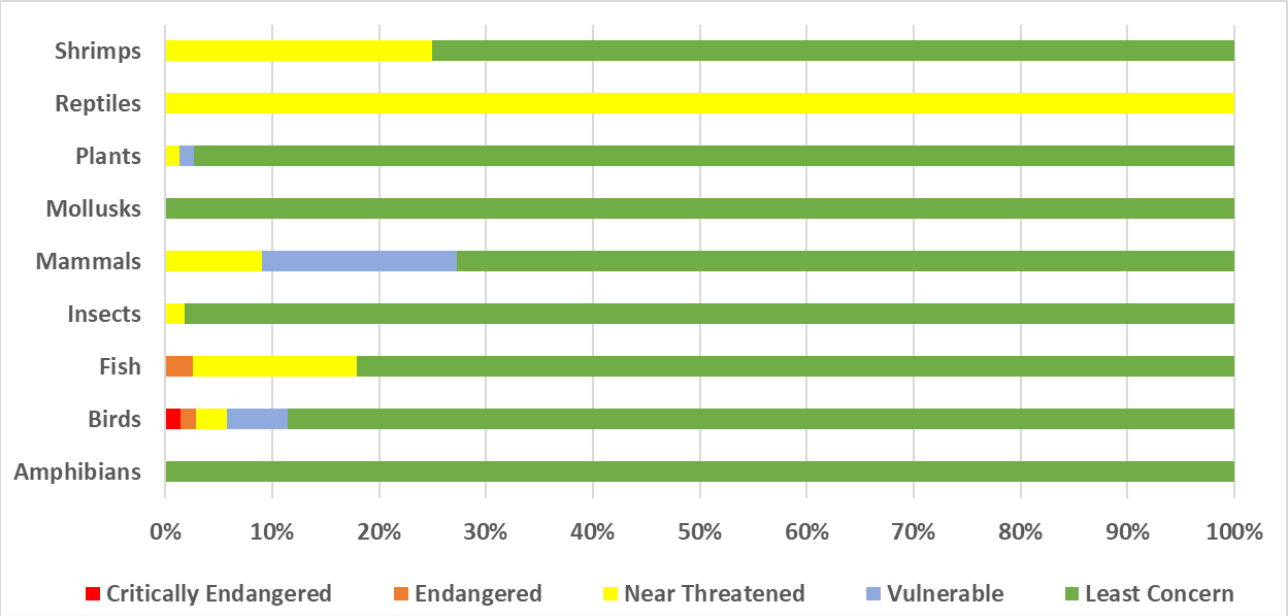


Figure 3-10. Proportion of threatened taxa for Lake Tana

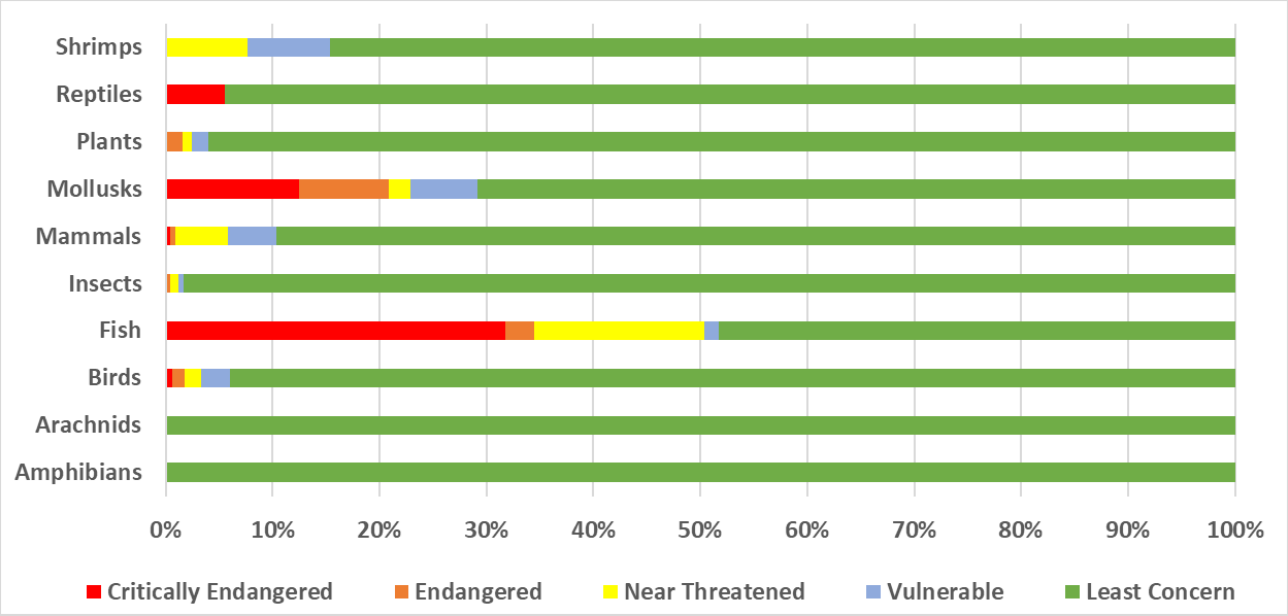


Figure 3-11. Proportion of threatened taxa for Lake Victoria

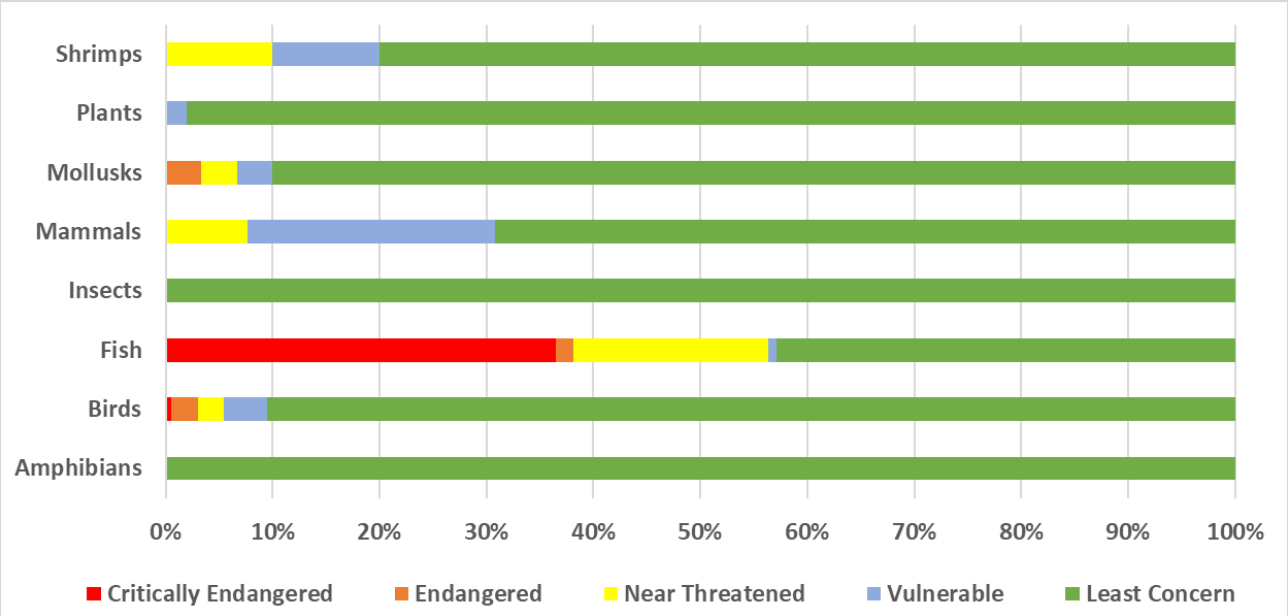


Figure 3-12. Proportion of threatened taxa for the Mara wetlands

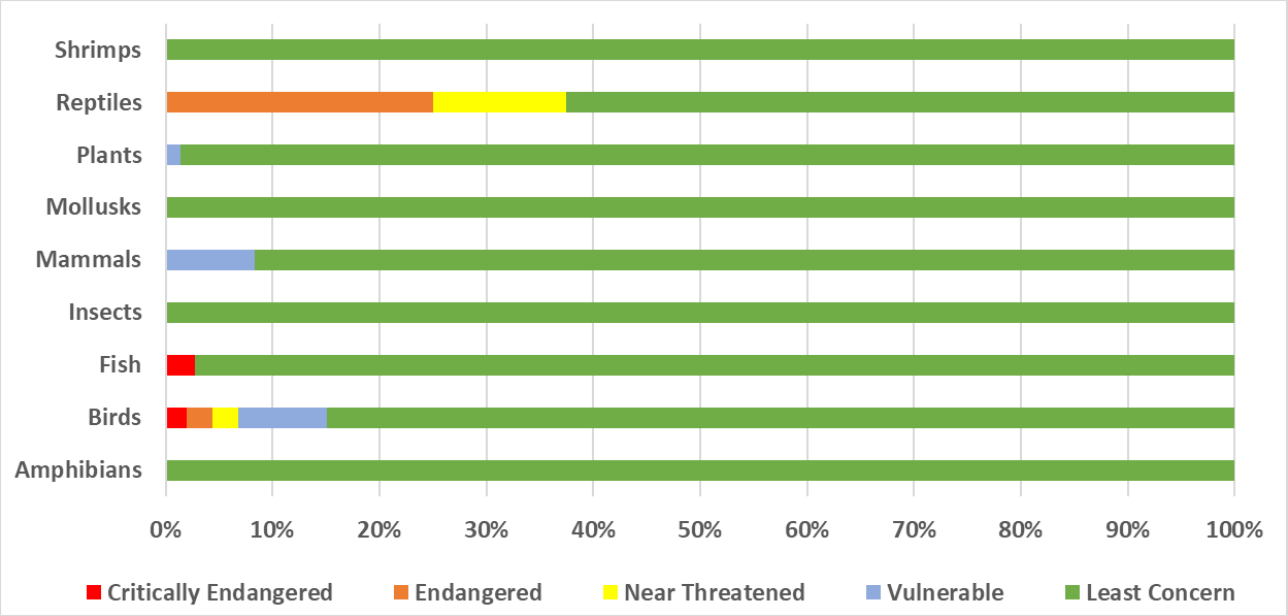


Figure 3-13. Proportion of threatened taxa for the Nile Delta

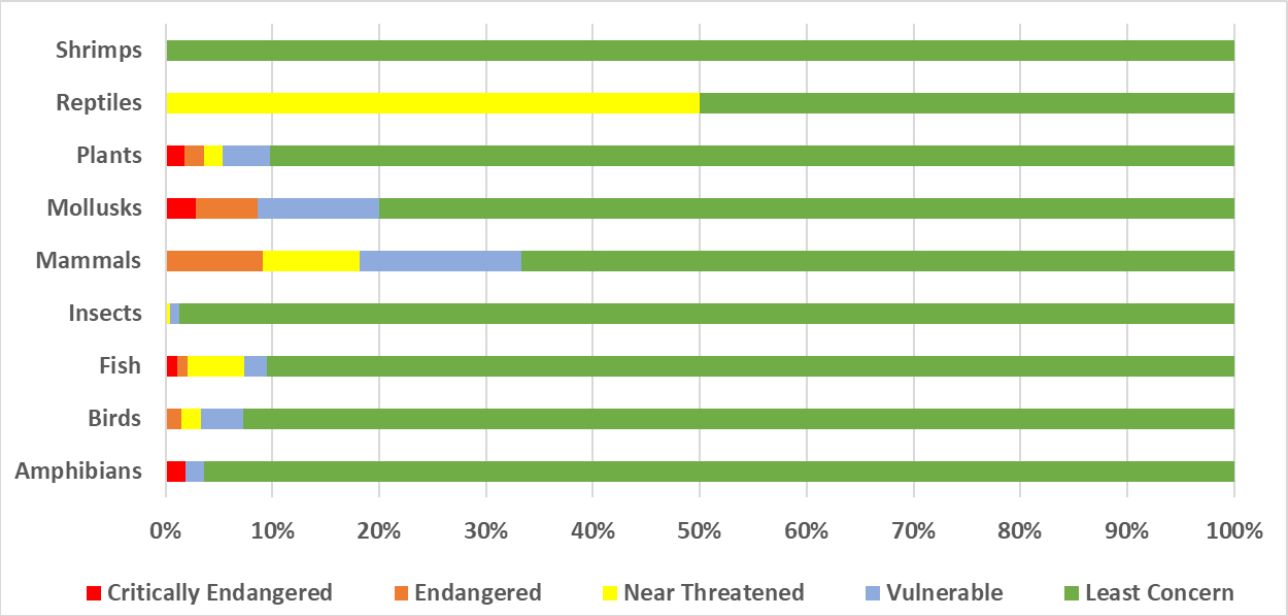


Figure 3-14. Proportion of threatened taxa for the Semliki wetlands

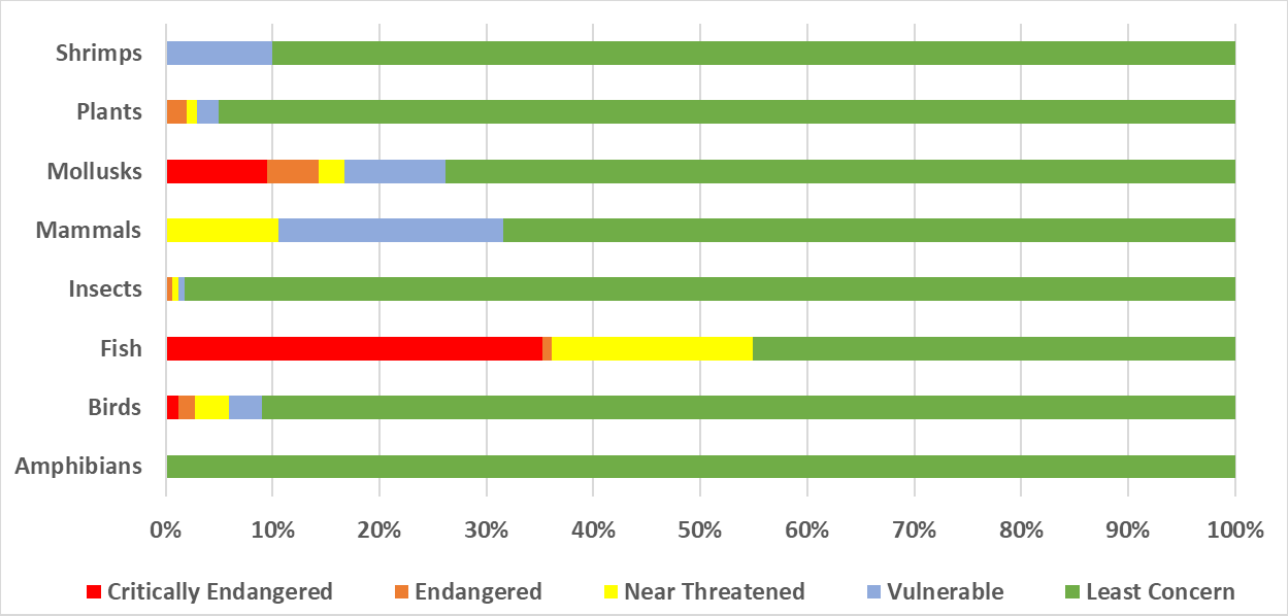


Figure 3-15. Proportion of threatened taxa for the Sio Nzoia Yala Nyando wetlands

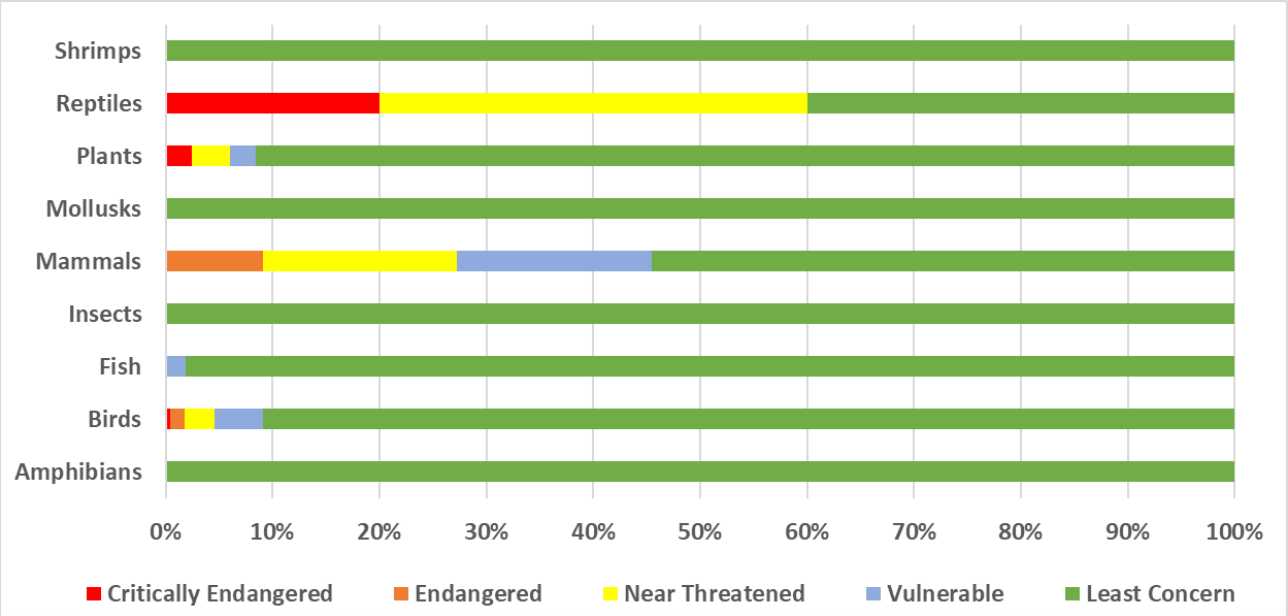


Figure 3-16. Proportion of threatened taxa for the Sudd wetlands

3.4 Flagship Species

A flagship species is a species selected to act as an ambassador, icon or symbol for a defined habitat, issue, campaign or environmental cause e.g. Shoebill, Hippo, Nile Crocodile. In conservation biology, a flagship species is a species chosen to raise support for biodiversity conservation in a given place or social context. Species selected since the idea was developed in 1980s include widely recognised and charismatic species. Sixty-one flagship species have been recognised within the Nile River basin. A summary of these is shown in Table 3-3 per wetland and fully listed in Appendix 3. It should be noted that several flagship species that occur or visit wetlands are not necessarily wetland specific species. The most important flagship species for conservation and management focus are listed Table 3-4 in for each wetland group.

Table 3-3. The number of flagship species per wetland / complex

Wetland	Number of Flagship Species
Bahr el Ghazal	28
Baro/Akobo Sobat Wetlands (Machar Marshes)	31
Dinder	27
Kagera	28
Lake Kyoga	30
Lake Tana	22
Lake Victoria	37
Mara	25
Nile Delta	22
Semliki	36
Sio Nzoia Yala Nyando	22
Sudd	32

Table 3-4. Most Important flagship species per wetland / complex

Flagship Species	Wetland Group												
	Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
African Openbill	1		1	1	1	1	1	1	1	1	1	1	1
African Pygmy Goose	1		1	1	1	1	1	1	1	1	1	1	1
Basra Reed Warbler			1					1		1			1
Black Crowned Crane	1		1	1			1						1
Erismature maccoa											1		
Goldbelly Reed Frog											1		
Graham's tilapia					1	1		1	1				
Grauer's Swamp-warbler											1		
Grey Crowned Crane					1	1		1	1		1	1	
Madagascar Pond-Heron					1	1		1	1		1	1	
Nile Lechwe	1		1										1
Nile Softshell Turtle	1		1	1			1			1	1		1
Nubian Flapshell Turtle			1	1									1
Papyrus Yellow Warbler					1			1	1		1	1	
Pel's fishing owl			1	1			1	1	1		1	1	1
Pied Oystercatcher										1			
Sahelian Flapshell Turtle			1	1									1
Shoebill	1		1		1	1		1	1		1	1	1
Sitatunga	1				1	1		1	1		1		1
Victoria Tilapia					1	1		1	1				

Flagship Species	Wetland Group												
	Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Vundu Catfish		1	1		1		1	1	1	1	1	1
White-eared kob	1	1			1					1		1

3.5 Umbrella and Keystone Species

Umbrella species are species selected for making conservation-related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat. e.g. *Papyrus*, *Phragmites* or *Vossia* (Hippo grass). These species represent discernible communities, within which they are dominant, that are associated with other less dominant species that share the same niche preferences. Managing umbrella species therefore enables automatic management of the species with which they are almost always associated.

A keystone species is a plant or animal that plays a unique and crucial role in the way an ecosystem functions. Without keystone species, the ecosystem would be dramatically different or cease to exist altogether. Some keystone species, such as the wolf, are also apex predators. e.g. Papyrus, which is also be umbrella and indicator species, can contribute to channelling the flow of water. Keystone and umbrella species are frequently the same, and usually wetlands indicators as well. The number of umbrella and keystone species within each wetland is summarised in Table 3-5 and listed in Appendix 4.

Table 3-5. The number of Keystone &Umbrella species per wetland / complex

Wetland	Number of Keystone & Umbrella Species
Bahr el Ghazal	9
Baro/Akobo Sobat Wetlands (Machar Marshes)	11
Dinder	11
Kagera	11
Lake Kyoga	11
Lake Tana	7
Lake Victoria	18
Mara	10
Nile Delta	6
Semliki	13
Sio Nzoia Yala Nyando	12
Sudd	15

3.6 Indicator Species

Indicator species, an organism that serves as a measure of the environmental conditions that exist in a given locale. For example, greasewood indicates saline soil; mosses often indicate acid soil. A bioindicator is any species (an indicator species) or group of species (indicator guild) whose function, population, or status can reveal the qualitative/quantitative status of the environment. There are many wetland indicator species

within the Nile River Basin. Not only are these species wetland obligates, they are also indicators of the wetland itself, and frequently of a specific habitat type, resource or functional attribute. The indicators within the basin are summarised in Table 3-6 for each wetland and listed in full in Appendix 5. It is notable, and expected, that the wetlands being assessed have similar numbers of indicator taxa, with only slightly higher numbers in wetlands associated with large lakes.

Table 3-6. Indicator species for each wetland and within each taxon grouping

	Taxon Group							
Wetlands	Amphibians	Birds	Fish	Insects	Mammals	Plants	Reptiles	Total
Bahr el Ghazal	4	72	2		15	26	2	121
Baro/Akobo Sobat Wetlands (Machar Marshes)	4	79	3		9	31	4	130
Dinder	2	86	3		7	28	4	130
Kagera	7	79	6	1	7	40	1	141
Lake Kyoga	7	82	6	2	7	32	1	137
Lake Tana	2	84	1		3	28	2	120
Lake Victoria	14	90	6	2	12	50	2	176
Mara	7	75	6		6	33	1	128
Nile Delta		78	3		1	25	1	108
Semliki	11	87	7	1	10	41	2	159
Sio Nzoia Yala Nyando	11	72	5	1	6	39		134
Sudd	5	76	3		10	40	4	138
Total	74	960	51	7	93	413	24	1622

3.7 Important Species

Species can be important for different reasons. This section outlines species that are important because they are alien species that have a significant negative impact on the integrity and diversity of wetlands in the basin. These are summarised in Table 3-7. Note that the Nile Perch is indigenous to most portions of the Nile River, but was introduced to Lake Victoria in the 1950's where it is seen and functions as an invasive alien species.

Table 3-7. Important alien species per wetland

Wetlands	Floating fern *Azolla nilotica*	Water Hyacinth *Eichhornia crassipes*	Red River Gum *Eucalyptus*	Nile Perch *Lates niloticus*	Water lettuce *Pistia stratiotes*	Guppy *Poecilia reticulata*
Bahr el Ghazal					1	
Baro/Akobo Sobat Wetlands (Machar Marshes)		1		1	1	
Dinder	1			1	1	
Kagera	1	1			1	
Lake Kyoga	1			1	1	
Lake Tana				1	1	
Lake Victoria	1	1	1	1	1	1
Mara	1			1	1	
Nile Delta	1	1		1	1	
Semliki	1			1	1	
Sio Nzoia Yala Nyando		1				
Sudd	1	1		1	1	
Total:	8	5	1	9	11	1

3.8 Endemism

Endemism is the ecological state of a species being unique to a defined geographic location, such as an island, nation, country or other defined zone, or habitat type; organisms that are indigenous to a place are not endemic to it if they are also found elsewhere. With respect to the wetlands of interest in this study, the following is noteworthy:

- Bahr el Ghazal
  - Home to the endemic *Ontragus megaceros* (Nile Lechwe).
- Baro/Akobo Sobat Wetlands (Machar Marshes)
  - Also home to the endemic *Kobus megaceros* (Nile Lechwe) and the Baro River has a high fish species diversity comprising a mixture of Nilo-sudanic, East African and endemic species.
- Kagera
  - Two of the important fish species found within the Kagera wetlands are *Labeo victorianus* (critically endangered) and *Synodontis ruandae*, a fish species endemic to the Akagera River System.
- Lake Kyoga
  - Lake Kyoga is of international importance with regards to the conservation of endemic wetland species and its high concentration of endemic cichlid fish species. Over 46 fish species are sheltered by Lake Kyoga, along with numerous crocodiles. Lake Kyoga satellite lakes are important refuges for the endemic fish species as they have not yet been invaded by the Nile Perch.
- Lake Tana
  - Some of the 17 endemic fish species of Lake Tana include *Garra regressus*, *G. tana*, *Barbus tanapelagius*, *Afronemacheilus abyssinicus, Labeobarbus intermiduis. La* (Shkil et al, 2017).
- Lake Victoria
  - Lakes Victoria, Kyoga, and George are of international importance in conservation of endemic wetland species, with a very high concentration of endemic cichlid fish species (NBI, 2010, in NSOER, 2014). In Uganda, 324 species of cichlids are found, of which 292 are

endemic to Lake Victoria. Not all these species utilise wetlands however. In addition, 42 non-cichlid species are found throughout Uganda's aquatic systems. Of these, 15 are endemic to Lake Victoria (NSOER, 2014). The Williams' mud turtle is also endemic to the area.

- Mara
  - Because the Mara wetlands are connected to Lake Victoria, many of the indigenous fish species that also utilise wetlands visit or occur in the Mara wetlands.
- Nile Delta
  - Two endemic species to the Nile Delta are *Sonchus macrocarpus* and *Zygophyllum aegyptium.*
- Semliki
  - The Papyrus swamps of Lakes Edward and George are considered to be biodiversity hotspots due to the high percentage of endemic species, globally important species and threatened species. One such contributing species is the endemic papyrus, *hioropetagracilirosiris.* Lake George also has a very high concentration of endemic cichlid fish species (USAID, 2015).
- Sio Nzoia Yala Nyando
  - The Sio wetland is identified as an Important Bird Area as it has more than 300 bird species which include three papyrus endemics: Papyrus Gonolek (*Laniarius mufumbri*), White-winged Warbler (*Bradypterus carpalis*) and Papyrus Canary (*Crithagra koliensis*).
- Sudd
  - *Suddia sagitifolia*, the single higher plant presumed endemic to the Sudd. It is rhizomatous, with nodal rooting, reaches a height of 2.5 m and grows within papyrus swamp.

The numbers of taxa and the general regions to which they are endemic are shown for each of the wetlands in Table 3-8. It is noteworthy that most wetlands associated with lake environments have higher levels of endemism due to the contribution of endemic fish species in the lakes of the African rift valley. A simple ranking system based on the total number of endemic taxa shows that Lake Victoria ranks the highest and adjoining wetlands are also high (Mara and the Sio Nzoia Yala Nyando complex) due to shared species. The Semliki wetlands are also moderately noteworthy.

Table 3-8. Numbers of endemic taxa for each wetland and a ranking according to numbers

Wetland / Wetland Complex	Region of Endemism								Total	Rank
	General	Country / Region	Lake George & the Kazinga	Mediterranean Region	Central Africa	Eastern Africa	Northeastern Africa	Northern Africa		
Bahr el Ghazal	2	1			6				9	0.04
Baro/Akobo Sobat Wetlands (Machar Marshes)	8					1	6		15	0.07
Dinder	1	1				1	8		11	0.05
Kagera	1					32			33	0.15
Lake Kyoga						39			39	0.17
Lake Tana	6					1	19		26	0.12
Lake Victoria	2					223	1		226	1.00
Mara						195			195	0.86
Nile Delta	3	1		2				3	9	0.04
Semliki			1		25	43			69	0.31
Sio Nzoia Yala Nyando						203			203	0.90
Sudd	11	1			6	1	3		22	0.10

4 Wetland Habitat Integrity & Diversity

Species diversity and habitat diversity are the two major components of biodiversity. Species diversity has been explored in Chapter 3. Habitat diversity can be assessed in terms of both habitat types (structure and proportion) and the "condition" or integrity of habitats. In our case, these are wetland specific habitats that comprise the full extent of the wetland.

Different types of Wetlands exist, and are recognized, but various wetland classification systems exist, albeit with much overlap and agreement since the drivers of wetland formation and function feature largely in their classification. The RAMSAR classification system is a good place to start and underpins many of the other classification systems. The system begins by broad distinction of wetlands into Marine or Coastal wetlands, Inland wetlands and Human-made wetlands. The types of marine and coastal wetlands included in their classification are permanent shallow marine waters, Marine subtidal aquatic beds, coral reefs, rocky marine shores, sand, shingle or pebble shores, estuarine waters (these include deltas), intertidal mud, sand or salt flats, intertidal marshes, intertidal forested wetlands coastal brackish/saline lagoons, coastal freshwater lagoons and karst and other subterranean hydrological systems. Inland wetland types include permanent inland deltas, permanent rivers, streams or creeks, seasonal, intermittent or irregular rivers, streams or creeks, permanent freshwater lakes (over 8 ha; includes large oxbow lakes), seasonal, intermittent freshwater lakes (over 8 ha; includes floodplain lakes), permanent saline, brackish or alkaline lakes seasonal, intermittent saline, brackish or alkaline lakes and flats, permanent saline, brackish or alkaline marshes or pools, seasonal or intermittent saline, brackish or alkaline marshes or pools, permanent freshwater marshes or pools, seasonal or intermittent freshwater marshes or pools, non-forested peatlands, alpine wetlands, tundra wetlands, shrub-dominated wetlands, freshwater, tree-dominated wetlands (such as swamp forests), forested peatlands, freshwater springs, geothermal wetlands and karst and other subterranean hydrological systems.
(refer to https://www.environment.gov.au/water/wetlands/ramsar/wetland-type-classification)

4.1 Methods

Several tools have been designed to calculate wetland integrity (MacFarlane *et al.*, 2007; SANBI & DWS, 2014a; DWS, 2014b) but the method employed is largely determined by the availability and quality of relevant data. Pertinent data for this study were satellite data of land use / cover types. As such, a tool that does not require site visits was required. The Wetland Integrity tool employed by DWS (SANBI & DWS, 2014a) was mainly designed for wetland offset calculations, but it has within it, two modules that calculate integrity using aerial data. The wetland module requires additional detailed data concerning geomorphology and hydrology, but the buffer zone integrity module is simply based on the land use cover proportions within a demarcated area. This module was adapted for use in this study to calculate within-wetland integrity using available land use cover data. Each land use category was assigned a value from 0 to 1 based on its intrinsic ecological value, where 1 denotes a naturally intact system (highest ecological value) and 0 a completely degraded and destroyed system with no ecological value (see Table 4-1 for ecological value scores of land use categories used in this assessment).

The aerial proportions of each land use category within the delineated wetland (wetland area) contribute to the overall integrity score by virtue of their internal ecological value score/s. The calculation is based on the proportions of these land use value scores within the wetland and the output scores represent the internal integrity of the wetland (or delineated area being assessed). The empirical nature of the tool outputs lends itself well to between-wetland comparison and assessment over time (monitoring), as well as proposed response to scenarios. Furthermore, these integrity scores can be categorised into ecologically meaningful categories which have predefined condition statements. This is particularly useful for management orientated applications. This categorisation into ecological categories has been adapted from accepted methods outlined by Kleynhans (1996; 1999). Table 4-2 shows the ecological category (management interpretation) of the outcome integrity scores (adapted from Kleynhans, 1999).

Table 4-1. Definitions of land use categories and their assigned ecological value scores

Land use category	Definition	Value score
Water	Open water, includes permanent bodies e.g. lakes and rivers, but also flooded areas during floods	1
Papyrus	Mostly permanently flooded non-woody vegetation, this group dominated by Papyrus	1
Reeds	Mostly permanently or seasonally flooded non-woody vegetation, this group is dominated by Phragmites (reeds)	0.9
Shrubland	Short woody and grass vegetation mixture, no discernible agriculture but will serve as important grazing areas and can be overgrazed	0.8
Forest	Taller and higher density woody vegetation, alien and indigenous species indiscernible	0.5
Agriculture	Any form of formal or informal agriculture, some may show as bare land; includes crops and old fields	0.3
Wetland grassland	Non-woody dominated short vegetation, dominated by grasslands and by proximity to marshes are seasonally flooded	0.9
Desert, bare soil	Could include fallow fields (formal or informal agriculture) or areas of erosion, or naturally open areas such as desert	0.2
Settlement	Includes high and low density, formal and informal, discernibility is scale dependent	0.1

Table 4-2. Generic ecological categories for integrity scores (modified from Kleynhans 1996 & Kleynhans 1999)

Ecological Category	Generic description of ecological condition	Score Range (% of maximum theoretical total)
A	Unmodified/natural, close to natural or close too predevelopment conditions within the natural variability of the system drivers, hydrology, physico-chemical and geomorphology. The habitat template and biological components can be considered close to natural or to pre-development conditions. The resilience of the system has not been compromised.	>92 - 100
A/B	The system and its components are in a close to natural condition most of the time. Conditions may rarely and temporarily decrease below the upper boundary of a B category.	>88 - <= 92
B	Largely natural with few modifications. A small change in the attributes of natural habitats and biota may have taken place in terms of frequencies of occurrence and abundance. Ecosystem functions are essentially unchanged.	>82 - <=88
B/C	Close to largely natural most of the time. Conditions may rarely and temporarily decrease below the upper boundary of a C category.	>78 - <=82
C	Moderately modified. Loss and change of natural habitat and biota have occurred in terms of frequencies of occurrence and abundance. Basic ecosystem functions are still predominantly unchanged. The resilience of the system to recover from human impacts has not been lost and it is ability to recover to a moderately modified condition following disturbance has been maintained.	>62 - <=78
C/D	The system is in a close to moderately modified condition most of the time. Conditions may rarely and temporarily decrease below the upper boundary of a D category.	>58 - <=62
D	Largely modified. A large change or loss of natural habitat, biota and basic ecosystem functions have occurred. The resilience of the system	>42 - <=58

	to maintain the category has not been compromised and the ability to deliver ecological goods and services have been maintained.	
D/E	The system is in a close to largely modified condition most of the time. Conditions may rarely and temporarily decrease below the upper boundary of a E category. The resilience of the system is often under severe stress and may be lost permanently if adverse impacts continue.	>38 - <=42
E	Seriously modified. The change in the natural habitat template, biota and basic ecosystem functions are extensive. Only resilient biota may survive and it is highly likely that invasive and problem (pest) species may dominate. The resilience of the system is severely compromised as is the capacity to provide ecological goods and services. However, geomorphological conditions are largely intact but extensive restoration may be required to improve the system's hydrology and physico-chemical conditions.	20 - <=38
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete change of the natural habitat template, biota and basic ecosystem functions. Ecological goods and services have largely be been lost This is likely to include severe catchment changes as well as hydrological, physico-chemical and geomorphological changes. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible. Restoration of the system to a synthetic but sustainable condition acceptable for human purposes and to limit downstream impacts is the only option.	<20

4.2 Wetland Integrity Scores

The within-wetland integrity scores calculated for the wetlands in this study are shown in Table 4-3, over time, spanning 1985, 2005 and 2018. For ease of view they have been colour-coded according to each assigned ecological category. Many of the wetlands have high integrity scores that equate to desirable ecological categories (B/C or higher), but several wetlands have low integrity scores that are considered ecologically unacceptable (D/E or below). Several of these scores seem higher than expected so it is important to note that these scores are dependent on the land use data resolution and are intended for standardisation between the wetlands. It is known that agriculture, in particular, which largely drives the deterioration of integrity, can be difficult to discern in land use categorisation and is hence often underestimated. This would translate into an inflated integrity score. Nevertheless, this simple integrity score calculation facilitates the relative comparison of different scenarios and how they might affect wetland integrity. The main driver behind this appears to be a dynamic between water level (area of open water) and agriculture (Figure 4-1). As the water level decreases additional area becomes available for agriculture and vice versa. This will directly affect the integrity score. Data suggests that the integrity scores increased as the water levels also increased and the area prone to agriculture therefore decreased. This suggests that water quantity is clearly a management tool for wetland integrity, and by association also therefore condition.

Table 4-3. Wetland integrity scores for 1985 and 2018

Wetland	Integrity Scores 1985	2018
Akanyaru_River_Swamps	0.62	0.84
Akanyaru_Swamps	0.61	0.88
Badigeru_Swamp	0.74	0.75
Bahr_el_Ghazal	0.79	0.79
Dinder_Floodplain	0.80	0.50
El_Roseires	0.83	0.91
Fincha_Chomen	0.96	0.93
Gebel_Auliya	0.89	0.90
Kagera_Swamps	0.87	0.96
Kamiranzovu_Swamp	0.37	0.30
Kenamuke_Kobowen_Swamp	0.78	0.67
Khasm_el_Girba	0.99	0.95
Kyoga_Kwania_Swamp_Complex	0.92	0.93
Lake_Ambadi	0.89	0.87
Lake_Anyi	0.80	0.82
Lake_Bardawil	no data	no data
Lake_Bisina	0.94	0.98
Lake_Bunyonyi	0.95	0.96
Lake_Burera	0.98	0.99
Lake_Burullus	0.56	0.81
Lake_Cohoha_North	0.73	0.82
Lake_Cohoha_South	0.93	0.94
Lake_Edward	0.98	0.98
Lake_George	0.79	0.93
Lake_Idku	0.48	0.66
Lake_Kanzigiri	0.59	0.60
Lake_Manzala	0.93	0.89
Lake_Maryut	0.60	0.73
Lake_Mburo_Nakivali_System	0.67	0.76
Lake_Mugesera	0.89	0.92
Lake_Muhazi	0.91	0.96
Lake_Nabugabo	0.78	0.85
Lake_Nubia_Nasser	0.86	0.96
Lake_Nyiporo	0.82	0.82
Lake_Opeta	0.83	0.87
Lake_Qarun	0.98	0.99
Lake_Ruhondo	0.97	0.97
Lake_Rweru	0.99	0.99
Lake_Rwihinda	0.95	0.99
Lake_Tana	0.98	0.97
Lake_Wamala	0.76	0.91
Lake_Yirol	0.86	0.92
Lotilla_River_Swamp	0.82	0.80
Lutembe_Bay	0.93	0.93

A	>92 - 100
A/B	>88 - <= 92
B	>82 - <=88
B/C	>78 - <=82
C	>62 - <=78
C/D	>58 - <=62
D	>42 - <=58
D/E	>38 - <=42
E	20 - <=38
F	<20

Wetland	Integrity Scores	
	1985	2018
Mabamba_Bay	0.96	0.96
Machar_Marshes	0.78	0.78
Mara_Wetland	0.74	0.76
Murchison_Falls_Albert_Delta_Wetland_System	0.99	0.99
Nabajjuzi_Wetland	0.47	0.64
Nyabarongo_Wetlands	0.84	0.90
Nyando	0.58	0.65
Nzoia_River	0.66	0.76
Paysage_Aquatique_Protege_du_Nord	0.89	0.89
Rugezi_Marsh	0.73	0.78
Ruvubu_National_Park	0.36	0.36
Ruvyironza_River	0.30	0.30
Rwenzori_Mountains_Ramsar_Site	0.63	0.70
Sango_Bay_Musamba_Islands_Kagera_Wetland_System	0.54	0.70
Semliki_Valley_Wetlands	0.58	0.67
Sennar	0.80	0.73
Sio_Siteko	0.66	0.40
Sudd	0.86	0.87
The_Nile_Delta	0.39	0.35
Veveno_Adiet_Lilebook_Swamps	0.80	0.80
WN_Floodplain	0.82	0.81
Wadi_El_Rayan_Protected_Area	0.94	0.91
Winam_Gulf	0.99	0.99
Yala_Swamp	0.63	0.78

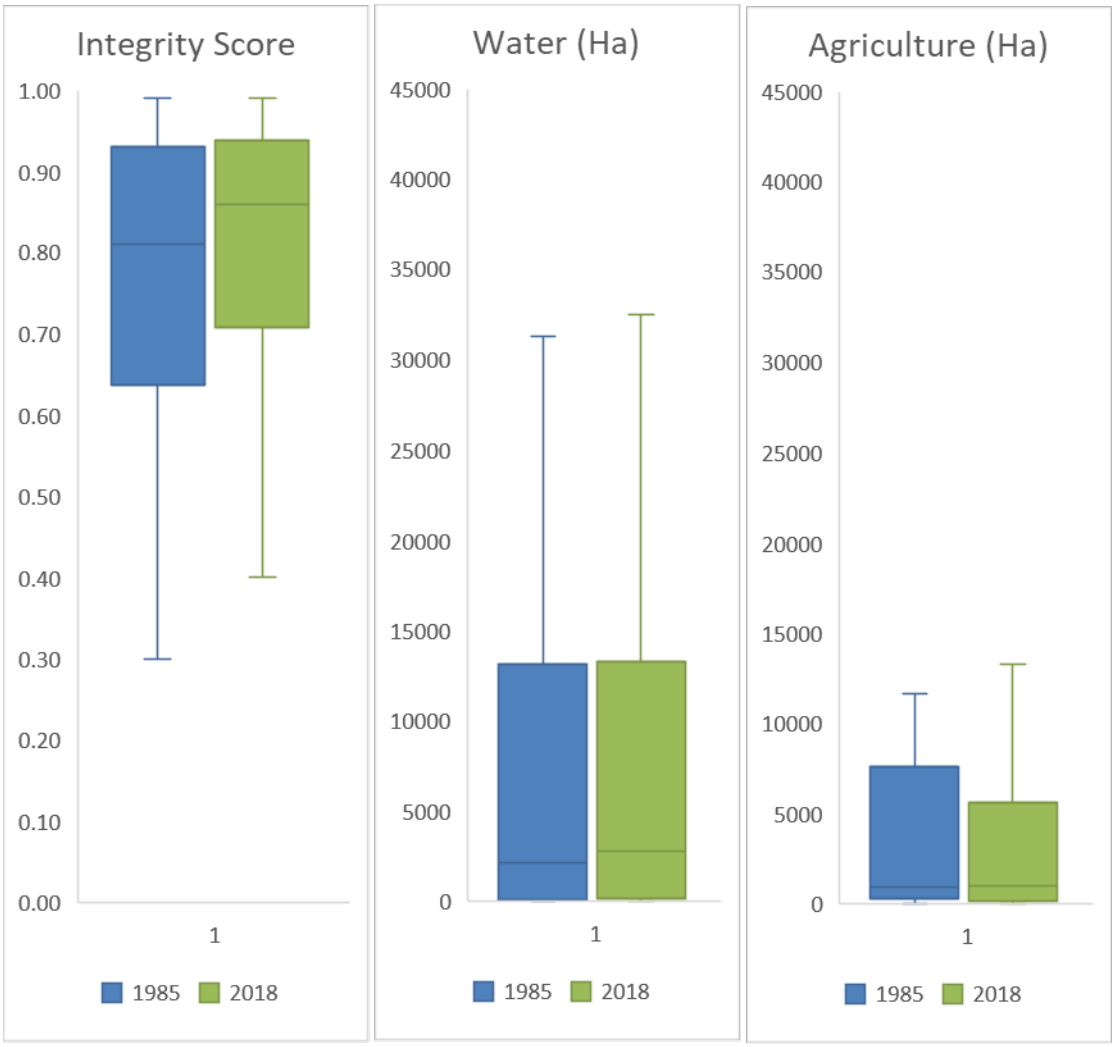


Figure 4-1. Box and whisker charts of wetland integrity scores (left), area of open water (Ha; centre) and area of agriculture (Ha; right) over two time periods (1985 and 2018)

4.3 Habitat Proportions

The integrity scores give one an idea (and measure) of the overall ecological condition of the wetland (or delineated area), but the actual proportions of the different habitat types (land use categories) are also an important characteristic of a biodiversity assessment, and may highlight internal dynamics (in response to perturbations or scenarios for example) not forthcoming if one simply focussed on the integrity score. For example, it is quite possible to alter the hydrological characteristics which would cause a shift in Papyrus, reeds and wetlands grassland, but the overall integrity would remain the same or similar because these habitats all have similar [high] ecological value. An assessor would only become aware of these shifts if the proportions were also being monitored.

There are several possible ways to account for habitat proportional changes: the most obvious is to simply compare absolute changes in area for each habitat type (land cover category). A simpler and more effective approach is proposed here whereby meaningful ratios are calculated and compared over time or under different scenarios. The following ratios that cater for important habitat structure and composition are proposed (see Table 4-4 for calculated ratios for each wetland):

- Woody: Non-woody – this is a ratio of all woody vegetation (shrubland & forest) to non-woody vegetation (Papyrus, reeds & wetland grassland), an important relationship which can often highlight a drying out of wetlands when flows are markedly reduced or highly regulated.

- Papyrus: Reeds – this is a ratio of ecologically valuable but different habitat types that are directly dependent on both wet and dry season flows (both high and low), but in different ways. A changing ratio could thus indicate a direct response to altered hydrology.
- Fringe: Grassland – this is a ratio of vegetation (fringe vegetation - Papyrus & reeds) that is dependent on all aspects of the flow regime to vegetation (wetland grassland) that is mainly dependent on the flooding component of the flow regime. A change in this ratio is likely to indicate an altered flooding regime but may also indicate severely reduced or regulated base flows.

Table 4-4. Ratios of select habitats for different wetlands and over time

	Woody: Non-woody			Papyrus: Reed			Fringe: Grassland		
Wetland	1985	2005	2018	1985	2005	2018	1985	2005	2018
Akanyaru_River_Swamps	1.2	0.1	0.0	3.8	203.1	1.9	6.5	11.5	0.1
Akanyaru_Swamps	1.2	0.1	0.0	4.3	233.8	9.9	1.5	4.7	0.1
Badigeru_Swamp	150.2	65.9	54.8	4.1				0.1	0.0
Bahr_el_Ghazal	2.9	7.1	4.6	0.5	0.7	0.7	2.4	0.4	0.4
Dinder_Floodplain			40.8						0.0
El_Roseires	14.0		0.1				5.1		0.0
Fincha_Chomen	0.3	1.5	1.8	13.4			22.5	0.7	0.0
Gebel_Auliya	2191.3		0.4				1.7		0.0
Kagera_Swamps	0.3	0.5	0.0	25.7	1831.7	18.2	34.3	28.1	1.0
Kamiranzovu_Swamp									
Kenamuke_Kobowen_Swamp	620.1	806.5	83.1	7.1				0.2	0.0
Khasm_el_Girba	170.5		0.0				0.0		0.0
Kyoga_Kwania_Swamp_Complex	0.6	0.2	0.2	5.5	2929.7	103.5	2.0	3.9	0.8
Lake_Ambadi	0.4	3.3	0.6	2.0	1.5	0.4	0.4	0.1	0.1
Lake_Anyi	21.8	17.7	19.1	0.0	0.1	0.0	23.7	0.5	0.9
Lake_Bardawil									
Lake_Bisina	0.4	0.1	0.0	2.1	299.3	40.5	1.6	1.8	0.4
Lake_Bunyonyi	22.5	2.8	12.0	7.3		2.5	25.0	36.0	0.6
Lake_Burera	19.4	0.4	14.5	1.5			1.7	1.7	0.0
Lake_Burullus	0.5		0.2				0.0		0.0
Lake_Cohoha_North	0.0	0.3	0.7	6.4	40.0	6.4	0.2	2.6	0.2
Lake_Cohoha_South	0.6	11.7	6.5	1.0	15.0	1.0	0.4	8.0	0.4
Lake_Edward	3.9	0.5	2.0	1.9	3126.0	2.9	11.9	13.7	0.1
Lake_George	1.0	0.9	0.6	3.8		347.5	37.8	30.1	1.4
Lake_Idku	0.7		0.3				0.0		0.0
Lake_Kanzigiri	0.0	0.8	0.2				0.0		0.0
Lake_Manzala	0.1		0.1				0.0		0.0
Lake_Maryut	0.8	3.4	0.2				0.0	0.0	0.0
Lake_Mburo_Nakivali_System	1.9	1.0	0.7	9.4	730.0	7.7	4.7	12.7	0.6
Lake_Mugesera	0.5	0.4	0.1	16.3		5.2	0.9	35.5	0.1
Lake_Muhazi	2.1	8.4	2.3	9.0				21.0	0.0
Lake_Nabugabo	0.3	1.1	0.4	83.9			1.7	3.0	0.0
Lake_Nubia_Nasser									
Lake_Nyiporo	7.1	4.4	9.9	4.5				1.5	0.0
Lake_Opeta	1.8	0.2	0.0	9.1	908.0	31.5	10.1	2.4	0.2
Lake_Qarun	9.3		0.6				0.0		0.0

Wetland	Woody: Non-woody			Papyrus: Reed			Fringe: Grassland		
	1985	2005	2018	1985	2005	2018	1985	2005	2018
Lake_Ruhondo	13.6	0.4	6.2	5.0			6.0		0.0
Lake_Rweru	0.0	1.8	1.7				0.0	71.0	0.0
Lake_Rwihinda	0.7	9.0	16.0				0.0		0.0
Lake_Tana	5.1		3.7	78.0		2.3	12.1		0.2
Lake_Wamala	0.8	2.5	0.7	20.5	1278.5	16.1	4.2	19.8	1.1
Lake_Yirol	1.6	1.6	2.2	0.2	1.6	0.0		2.2	4.9
Lotilla_River_Swamp	3.2	98.2	31.7	0.0				0.0	0.0
Lutembe_Bay	0.1	0.0	0.1	6.1		6.2	4.3	137.0	4.4
Mabamba_Bay	0.2	0.1	0.1	108.2	1369.2	108.2	35.6	11.8	8.3
Machar_Marshes	35.7	370.3	41.0	0.2	1.9	0.1	4.7	0.2	0.4
Mara_Wetland	1.8	1.7	0.4	14.1	5094.0	11.1	1.7	39.6	0.5
Murchison_Falls_Albert_Delta_Wetland_System	2.1	0.2	0.4	6.2		302.5	2.4	2.6	0.2
Nabajjuzi_Wetland	1.5	2.9	2.4	22.2			22.4	49.2	0.0
Nyabarongo_Wetlands	0.2	0.2	0.0	4.1	1482.7	8.5	0.3	21.7	0.1
Nyando	4.4	0.2	2.7	10.8			145.0	98.6	0.0
Nzoia_River									
Paysage_Aquatique_Protege_du_Nord	0.0	5.3	0.0				0.0		0.0
Rugezi_Marsh	0.7	0.0	0.0	15.0	126.0	4.4		7.1	0.2
Ruvubu_National_Park	11.6	5.1	7.4	3.4			0.2	8.1	0.0
Ruvyironza_River									
Rwenzori_Mountains_Ramsar_Site	334.4	758.1	243.5				78.4	17.3	1.9
Sango_Bay_Musamba_Islands_Kagera_Wetland_System	0.7	0.5	1.2	19.5			23.6	20.8	0.0
Semliki_Valley_Wetlands	0.7	0.8	0.8	2.9			2.8	2.0	0.0
Sennar	4.3		0.8				10.2		0.0
Sio_Siteko	288.3	54.4					0.0		
Sudd	1.3	0.6	0.5	5.0	3.5	0.4	1.9	1.1	0.9
The_Nile_Delta	11.9	26108.3	0.7				0.0	0.0	0.0
Veveno_Adiet_Lilebook_Swamps	294.5	6092.9		0.0				0.0	
WN_Floodplain	3.0		2.7	0.7		0.4	40.8		8.4
Wadi_El_Rayan_Protected_Area									
Winam_Gulf	2.2	1.4	1.0	9.5		8.7	5.1	6.8	0.1
Yala_Swamp									

(missing values are where division was by zero).

An example with reference to ratios in Table 4-4 for the Sudd wetlands: The Sudd had a woody: non-woody ratio of 1.3 in 1985. This means that woody vegetation slightly dominated the system with 1.3 woody units for every non-woody unit (within the delineated area). This ratio decreased to 0.6 and 0.5 in 2005 and 2018 respectively i.e. woody vegetation became less dominant than non-woody vegetation. The actual areas of land use categories indicate that woody vegetation decreased from 1328839 Ha in 1985 to 843333 Ha and 751431 Ha in 2005 and 2018 respectively, while non-woody vegetation increased from 1008843 Ha in 1985 to 1394094 Ha and 1562872 Ha in 2005 and 2018 respectively. Within the non-woody vegetation, the fringe: grassland ratio also decreased over time from 1.9 in 1985 to 1.1 in 2005 and then to 0.9 in 2018 (Table 4-4). Area data indicate grassland increasing from 348482 Ha in 1985 to 669058 Ha in 2005 and to 829792 Ha in

2018, while fringe vegetation remained similar through the years, with smaller increases. Clearly, woody vegetation is being lost while grassland is increasing. The integrity scores over the same years indicate that the ecological category remained a B (0.86, 0.82 and 0.87 in 1985, 2005 and 2018 respectively) and the land use data indicate a fairly consistent intensity of agriculture in 1985 and 2018 but a marked increase in 2005.

It is therefore a likely hypothesis (from these data and in a situation where the integrity remains similar and high) that woody vegetation is being removed and used and grasslands persist in their place. While the integrity scores and proportional ratios facilitate accounting and monitoring of wetland resources, they do not necessarily provide causality for change but highlight a need for investigation should [significant] change occur. In many instances however, the ratios were found to be of limited value since division by zero was frequent or because small denominators, and changes therein, catered for wild swings in the data.

4.4 Habitat Types

At times, and especially if a wetland is small in extent, will a wetland be comprised of a single habitat type. Usually, and especially in large wetlands or wetland complexes, several habitat types comprise the overall wetland, and each generic habitat type may have variations in characteristics or seasonality. Various habitat types have been described in the basin wetlands. These are outlined in Appendix 6 and summarised per wetland in Table 4-5.

Table 4-5. Summary of habitats per wetland / complex

Habitat Type	Ecotype	Wetland											
		Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Yala Nzoia Nyando	Sudd
Open water Vegetation (Aquatic)	Open water: slow	1	1	1	1	1	1	1	1	1	1	1	1
	Open water: fast	1	1	1	1		1		1	1	1	1	
	Permanent channel	1	1	1	1	1	1	1	1	1	1	1	1
	Seasonal channel	1	1	1	1	1	1		1	1	1	1	1
	Permanent pool	1	1		1	1	1	1	1		1	1	1
	Seasonal pool	1	1	1	1	1	1	1	1	1	1	1	1
	Shallow lake				1	1	1	1	1	1	1	1	1
	Lagoon									1			1
Papyrus Marsh (permanent)	Permanently inundated fringe marsh, grass	1	1	1	1	1		1	1	1	1	1	1
	Permanently inundated fringe marsh, Papyrus	1	1		1	1	1	1	1		1	1	1
	Floating Papyrus mats					1		1	1			1	1
Reed beds (Phragmites)	Reeds (Phragmites)	1	1	1	1	1	1	1	1	1	1	1	1
	Bulrushes (Typha)	1	1	1	1	1	1	1	1	1	1	1	1
River flooded Grassland	Seasonally flooded floodplains (grassland)	1	1	1	1	1	1	1	1		1	1	1

Habitat Type	Ecotype	Wetland												
		Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Yala Nzoia Nyando	Sudd
Shrubland	Mostly floodplains or patches, less flooded than grasslands, or rainfall dependent	1	1	1	1	1	1		1		1	1	1
Swamp	Permanently inundated, medium to tall woody dominated				1						1	1	
Mud flats	Seasonal or cyclical, mostly not vegetated, always wet or in shallow water.							1		1			1
Woodland	Beyond flood zone, mostly terrestrial	1	1	1	1	1	1		1	1	1	1	1
Seepage Wetlands	hillslope, gradient, rain fed seeps, grasses		1		1		1		1		1	1	

5 Migration / Corridor Importance & Important Bird Areas

The aim of this task was to utilise key migration routes and important bird areas from existing data to assign a measure of importance (expressed below as a ranking) to wetlands, and also to highlight the importance of wetlands to mammal and fish migrations.

5.1 Important Birding Areas

The BirdLife International database was used to align Important Birding Areas (IBAs) to respective wetlands of interest. Names and detailed descriptions of these IBAs is outlined in Appendix 7 (Fishpool & Evans, 2001; BirdLife International, 2019) and summarised in Table 5-1. A ranking (measure of importance) of wetlands was derived using both the numbers of IBAs associated with wetlands as well as the area covered by all respective IBAs. In terms of the numbers of IBAs associated with wetlands, the Lake Victoria wetlands ranked the highest, but Semliki, Kagera, the Sio Nzoia Yala Nyando complex and the Nile Delta were also high (Table 5-1). Lake Tana, the Sudd and the Mara wetlands ranked the lowest since these wetlands harbour but a single IBA. The ranking of wetlands is different if the area of IBAs is used rather than the number of IBAs. In this case the Sudd ranks the highest, but the Baro/Akobo Sobat Wetlands (Machar Marshes) is also high.

Table 5-1. Numbers and area of IBAs per wetland / wetland complex, and ranking based on respective data

Wetland	IBA Count	Rank (Count)	IBA Area (Ha)	Rank (Area)
Nile Delta	5	0.50	203889	0.04
Dinder wetlands	2	0.20	2090000	0.38
Lake Tana wetlands	1	0.10	400000	0.07
Baro/Akobo Sobat Wetlands (Machar Marshes)	3	0.30	4544500	0.83
Sudd (Bahr el Jebel)	1	0.10	5500000	1.00
Bahr el Ghazal wetlands	0	0.00	0	0.00
Lake Kyoga wetlands	3	0.30	98100	0.02
Semliki wetlands incl. Lake Albert / George / Edward	7	0.70	1655100	0.30
Lake Victoria wetlands	10	1.00	537763	0.10
Kagera wetlands	6	0.60	303230	0.06
Mara wetlands	1	0.10	50000	0.01
Sio Nzoia Yala Nyando wetlands	5	0.50	9100	0.00

5.2 Migration Pathways

Many animals, and birds in particular, migrate, usually between breeding and wintering (non-breeding) areas. These pathways are not random and distinct pathways have been defined that include suitable habitats for feeding and resting along the way. Different species frequently group together to travel along similar routes, which have been loosely split into eight main flyways for birds (Figure 5-1). The African-Eurasian Flyway connects the breeding grounds of Europe and northern Asia with the wintering (non-breeding) grounds in Africa, including vital stop-over sites in the Middle East and Mediterranean Africa and Europe. The Wings Over Wetlands (WOW) Project was a large international wetland and waterbird conservation initiative that aimed to improve and conserve healthy and viable populations of African-Eurasian migratory waterbirds. This was achieved by

assisting a wide range of partners to conserve the key critical wetland areas that these birds require to complete their annual migrations across Africa and Eurasia, by improving international cooperation and by building local professional capacity (UNEP / CMS, 2012). Together with Wetland International and BirdLife Internationl, the WOW initiative developed a valuable web-based database / tool to facilitate their aim. The Critical Site Network (CSN) Tool is an online resource for the conservation of 294 species of waterbirds and the important sites upon which they depend in Africa and Western Eurasia (criticalsites.wetlands.org/en). This database was used, together with the IBAs, to relate wetland-dependent migratory species to the wetlands of interest to this study. The details of these species that utilise wetlands of interest to this study is outlined in Appendix 8 and summarised in Table 5-2. As before, the species counts were used to derive a simple ranking system to assign a value of migratory importance to wetlands. The ranking assigns a value of 1 (maximum possible) to the wetland with the most species and a proportional value to other wetlands (Table 5-2). The Nile Delta ranked the highest but the Sudd also ranked high, and both the Semliki and Lake Victoria wetlands had a moderate ranking, highlighting the importance of all four these wetlands / wetland complexes to the success of wetland-dependent bird migrations.

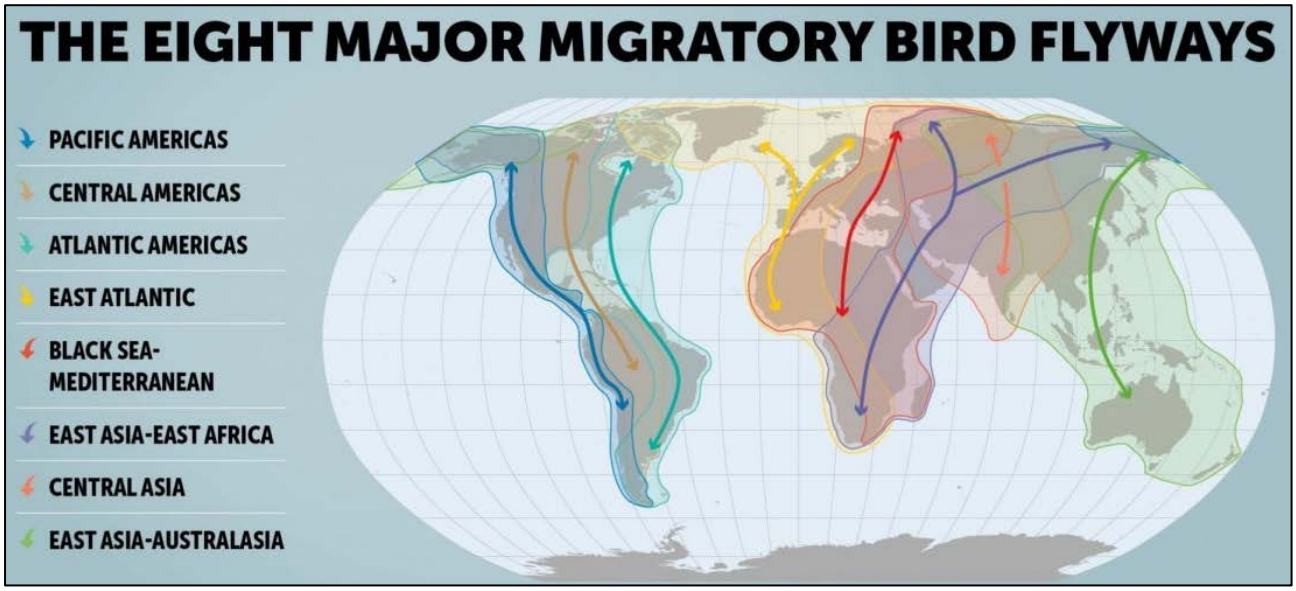


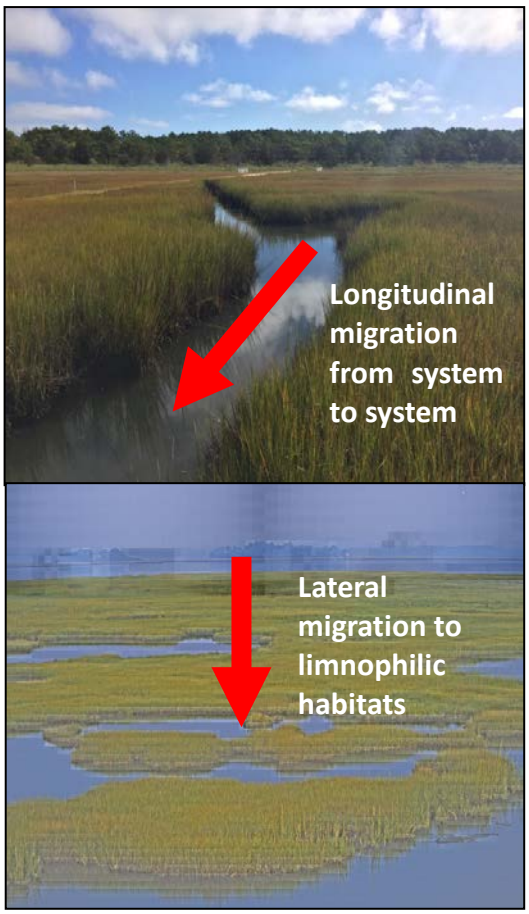
Figure 5-1. Major Migratory bird flyways (courtesy BirdLife International: https://www.birdlife.org/worldwide/programmes/migratory-birds)

Table 5-2. Numbers of bird species dependent on wetlands for migration, and ranking based on respective counts

Wetland	Species Count	Rank (Count)
Nile Delta	22	1.00
Dinder wetlands	2	0.09
Lake Tana wetlands	2	0.09
Baro/Akobo Sobat Wetlands (Machar Marshes)	3	0.14
Sudd (Bahr el Jebel)	19	0.86
Bahr el Ghazal wetlands	0	0.00
Lake Kyoga wetlands	1	0.05
Semliki wetlands incl. Lake Albert / George / Edward	10	0.45
Lake Victoria wetlands	7	0.32
Kagera wetlands	2	0.09
Mara wetlands	0	0.00

Sio Nzoia Yala Nyando wetlands	0	0.00

In addition to birds, the Sudd and portions of the Machar Marshes in particular are known for notable migrations of antelope. From January to June at least half a million antelopes converge on a vast savannah east of the White Nile, an area including the Sudd wetlands of South Sudan and the western Ethiopian swamps of Gambella. This mass movement of tiang and white-eared kob is Africa's second largest terrestrial wildlife migration, second only to the Serengeti's teeming masses of wildebeest. The white-eared kob is a medium sized, chestnut (female) or black and white (adult male) coloured antelope. From January until June, the animals move en masse north and east, from the floodplains of the Sudd and Bandingilo National Park across to Boma National Park and into Gambella National Park in Ethiopia. Keeping ahead of the rains they are joined by other antelopes – the tiang and Mongalla gazelles. The scale of this seasonal wildlife migration is still yet to be fully understood but as many as half a million plus animals travel in tightly packed columns that can stretch a staggering distance. In the dry season months from November to January, the direction of the migration is reversed, with the animals returning in search of nutritious grasses, watered and made rich by the silt left behind by the flooding of the White Nile (refer to PhD thesis by Marjan, 2014 for extensive detail about these migrations).



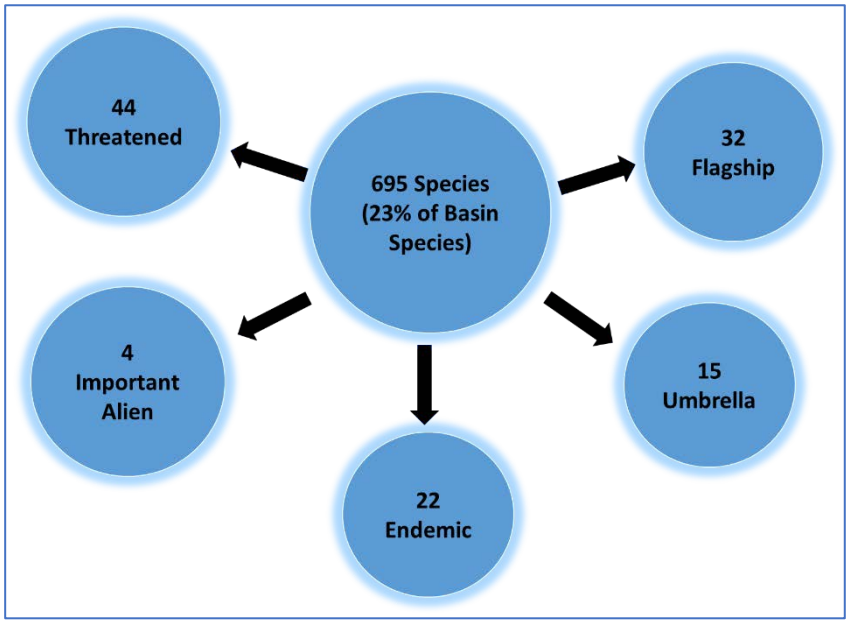
Many potamodromous fish species are dependent on wetland habitats for overall population wellbeing and especially for recruitment during flooding. Notable among these groups are the limnophilic species such as the Cyprinids (includes the carps, the true minnows, and their relatives, e.g. the barbs and barbels), Cichlids and Siluriformes (catfish). Fish migration includes both lateral and longitudinal en mass movement, can be extensive and is always flood dependent, highlighting the importance of river / wetland connectivity and interconnectivity as well as the conservation of critical hydrological flow parameters. Wetland floodplains, backwaters and limnophilic pool areas have been shown to facilitate greater fish productivity than open water lake ecosystems. In regulated systems, failure to provide a flow regime that maintains lateral connectivity with wetlands habitats results in large scale recruiting failure as fish do not spawn or survive if they do.

6 Putting it all Together: Case Study of the Sudd

One of the aims of the project was to utilise the biodiversity assessment and methodology as a showcase for the Sudd in order to demonstrate not only that biodiversity has value, but its role and recognition in wetland management. This chapter summarises the components of the biodiversity assessment for the Sudd and utilises the outcomes to derive a measure of Ecological Importance and Sensitivity (EIS), calculate a measure of wetland health and link biodiversity and its response to flow.

6.1 Biodiversity

The Sudd supports, to various degrees, 695 species / taxa, which is 23% of the total number of 3079 found using or residing within wetlands in the Nile River Basin. Of these 695 taxa 44 are threatened, 32 are considered flagship species, 15 are umbrella and flagstone species, 138 are considered indicators of wetland habitats, 4 are important alien species and 22 are endemic. Table 6-1 shows detail within broad taxa groups. The Sudd is also recognised as an important birding area with the highest rank in the basin when ranking using area. It hosts 19 bird species during their migrations and ranks 0.86 (high) compared to other wetlands in the basin. It is also well known for its vital role in the large white-eared kob and tiang migrations.



The Sudd is dominated by six main habitat types and fourteen ecotypes within those, each of which is described in Table 6-2. These data, together with land use data were used to derive a measure of wetland integrity within the Sudd delineation. Since the land use data was available over three time frames, the wetland integrity scores were calculated for the same three timeframes. Out of a maximum possible score of 1, the integrity scores were 0.86, 0.82 and 0.87 for 1985, 2005 and 2018 respectively. These all equate to an ecological category that is largely natural with few modifications. A small change in the attributes of natural habitats and biota may have taken place in terms of frequencies of occurrence and abundance but ecosystem functions are essentially unchanged. The land use categories themselves were used to describe important characteristics of the wetland such as proportions of habitats and zones but the actual areas of pertinent land use types are also valuable, such as Papyrus march, Reeds and Wetland Grassland.

	Integrity Scores		
Wetland	1985	2005	2018
Sudd	0.86	0.82	0.87

An example with reference to ratios in Table 4-4 for the Sudd wetlands: The Sudd had a woody: non-woody ratio of 1.3 in 1985. This means that woody vegetation slightly dominated the system with 1.3 woody units for every non-woody unit (within the delineated area). This ratio decreased to 0.6 and 0.5 in 2005 and 2018 respectively i.e. woody vegetation became less dominant than non-woody vegetation. The actual areas of land use categories indicate that woody vegetation decreased from 1328839 Ha in 1985 to 843333 Ha and 751431 Ha in 2005 and 2018 respectively, while non-woody vegetation increased from 1008843 Ha in 1985 to 1394094 Ha and 1562872 Ha in 2005 and 2018

respectively. Within the non-woody vegetation, the fringe: grassland ratio also decreased over time from 1.9 in 1985 to 1.1 in 2005 and then to 0.9 in 2018 (Table 4-4). Area data indicate grassland increasing from 348482 Ha in 1985 to 669058 Ha in 2005 and to 829792 Ha in 2018, while fringe vegetation remained similar through the years, with smaller increases. Clearly, woody vegetation is being lost while grassland is increasing. The integrity scores over the same years indicate that the ecological category remained a B (0.86, 0.82 and 0.87 in 1985, 2005 and 2018 respectively) and the land use data indicate a fairly consistent intensity of agriculture in 1985 and 2018 but a marked increase in 2005. It is therefore a likely hypothesis (from these data and in a situation where the integrity remains similar and high) that woody vegetation is being removed and used and grasslands persist in their place.

Table 6-1. Numbers of taxa according to taxon properties within the Sudd

Assignment	Category	Taxon Group								Total
		Amphibians	Birds	Fish	Insects	Mammals	Mollusks	Plants	Reptiles	
Threatened	Conservation Dependent					3				3
	Critically Endangered		1					2	1	4
	Endangered		2			2				4
	Near Threatened		10	1		4		3		18
	Vulnerable		6			4		3	2	15
Flagship			19	1		8			4	32
Umbrella				1		3		11		15
Indicators		5	76	3		10		40	4	138
Important Alien				1				3		4
Endemism	General			8		2		1		11
	Endemic (country/region)		1							1
	Central Africa				1		1	4		6
	Eastern Africa			1						1
	Northeastern Africa			2				1		3

Table 6-2. Habitat types and ecotypes dominating the Sudd

Habitat Type	Ecotype	Habitat Description
	Open water: slow	

Open water Vegetation (Aquatic)	Permanent channel Seasonal channel Permanent pool Seasonal pool Shallow lake	Permanently flooded and slow flowing, this ecotype is dominated by free-floating plants like *Eichhornia crassipes, Lemna gibba, Azolla nilotica* and *Nymphaea lotus* as well as submerged vegetation e.g. *Potamogeton, Trapa* and *Ceratophyllum* spp in both slow flowing waters and lakes.
Papyrus Marsh (permanent)	Permanently inundated fringe marsh, grass Permanently inundated fringe marsh, Papyrus Floating Papyrus mats	Permanently flooded and slow flowing but occurs on land that is flooded throughout the year. Dominated along the banks of the river by massive stands of *Cyperus papyrus, Vossia cuspidata, Typha domingensis.* Associates of the *Cyperus* swamp are climbers and ferns. Fringe Vegetation characterised by bands of *Vossia cuspidata* or *Echinochloa stagnina,* usually followed by Papyrus (*Cyperus papyrus*).
Reed beds (*Phragmites*)	Reeds (*Phragmites*) Bulrushes (*Typha*)	A permanently and seasonally flooded zone where the main, shallow flooded species*, Phragmites karka, Echinochloa pyramidalis,* and *Oryza barthii* are limited to sites where the maximum depth of flooding does not exceed 130 cm.
River flooded Grassland (Toich)	Seasonally flooded floodplains (grassland)	Seasonally flooded for about 90 days in the wet season. These grasslands are seasonally flooded to varying extent and depth by the river. During the rainy season the plains of this belt are often swampy and completely covered with luxuriant growth of tall grasses. Species composition and biomass is closely linked to soil type and degree of inundation. The tall grasses are dominated by *Phragmites, Sorghum, Hyparrhenia* and *Setaria* spp as well as *Oryza* and *Echinochloa.* Two grassland types are recognized. These are wild rice grassland dominated by *Oryza longistaminata* and *Echinochloa* grassland dominated by *Echinochloa pyramidalis*. Sedges, herbs and other grasses such as *Sporobolus pyramidalis* associate with the *Oryza* grassland. It is the most productive grassland type in terms of year-round grazing for livestock and wildlife because of the high protein content of dead materials of wild rice grass. The *Echinochloa* grassland associates with *Oryza* and legumes like *Desmodium hirtum*.
Shrubland	Mostly floodplains or patches, less flooded than grasslands, or rainfall dependent	Flooded seasonally or periodic, shorter duration than grasslands. Usually occurs as patchy higher-lying areas within a matrix of flooded grassland or as a zone beyond the flooding of the grasslands but distinct from the taller wooded (tree) areas.
Woodland	Beyond flood zone, mostly terrestrial	Only floods with infrequent extreme events, this ecotype is distinct from the grasslands and is higher in level. It is the well drained areas around the floodplains. This rain fed belt is an open mixed *Acacia* forest supporting several species of trees and shrubs and a luxuriant growth of grasses. The tree vegetation is dominated by *Acacia seyal, Acacia sieberiana*

and *Balanites aegyptiaca*. The tree vegetation is an important source of firewood and building poles. *Balanites* has additional food and medicinal values.

6.2 Ecological Importance & Sensitivity

The outcomes from the biodiversity assessment were used to derive a measure of Ecological Importance and Sensitivity (EIS) for the Sudd. The EIS model was developed by Dr CJ Kleynhans (DWAF, 1999). The ecological importance of a river or wetland is an expression of its importance to the maintenance of biological diversity and ecological functioning on local and wider scales. Ecological sensitivity (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Resh *et al.,* 1988; Milner, 1994). Both abiotic (habitats) and biotic (biota) components of the system are taken into consideration in the assessment. This approach estimates and classifies the EIS of the wetland by considering a number of components surmised to be indicative of these characteristics. The following ecological aspects are considered as the basis for the estimation of EIS (Kleynhans in DWAF, 1999):

- The presence of rare and endangered species/ taxa, unique species/ taxa (i.e. endemic or isolated populations) and communities, intolerant species and species diversity for both instream and wetland components
- Habitat diversity is also considered. This includes specific habitat types that are flow dependent or critical for recognised taxa.

The EIS accounts for biodiversity in its general form (i.e., Noss, 1990) and is usually based on available information such as:

- The importance of a particular wetland or of river to provide connectivity within its greater landscape i.e. whether it provides or assists a migration route or has importance as a corridor for species
- The presence of conservation or relatively natural areas within the wetland also serves as an indication of Ecological Importance and Sensitivity
- The sensitivity (or fragility) of the system and its resilience (i.e. the ability to recover following disturbance) of the system to environmental changes is also considered.

A number of biotic and habitat determinants considered to be important for the determination of EIS are scored on a rating of 0 to 4 (Table 6-3). The median of these scores is calculated to derive the EIS category (Table 6-3). The confidence level (out of 4) gives an indication of how reliable the result may be considered according to the availability of data. Confidence may be Low (0-1), Moderate (1.1-2), High (2.1-3) or Very High (3.1-4).

Table 6-3. EIS categories (Modified from DWAF 1999)

EIS	General Description
VERY HIGH 2.1-4	Quaternaries/delineations that are considered to be unique on a national or even international level, based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers/wetlands (in terms of biota and habitat) are usually sensitive to flow modifications and have no or only a small capacity for water use.
HIGH 2.1-3	Quaternaries/delineations that are considered to be unique on a national scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers / wetlands (in terms of biota and habitat) may be sensitive to flow modifications, but in some cases, may have substantial capacity for water use.
MODERATE 1.1-2	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers / wetlands (in terms of biota and habitat) are usually not very sensitive to flow modifications and often have a substantial capacity for water use.
LOW 0-1	Quaternaries/delineations that is not unique at any scale. These rivers / wetlands (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have a substantial capacity for water use.

The resultant EIS for the Sudd based on the data emanating from the biodiversity assessment is HIGH (see Table 6-4 for metrics and reasons). The management translation of a HIGH EIS is that the Sudd is considered to be unique on a national scale due to its biodiversity (habitat diversity, species diversity, unique species, rare and endangered species, flow dependency and role in migratory processes, including IBAs).

Table 6-4. Results of EIS assessment for the Sudd utilising data from the biodiversity assessment

DETERMINANTS / METRICS	PRESENT (0-4) RATING	PRESENT (0-4) CONF	COMMENTS
Wetland Biota			
Rare & endangered	3	3	44 threatened taxa, ranked 5th between wetlands, only lower than wetlands with lake environments
Unique (endemic, isolated, etc.)	2.5	3	22 endemic taxa but not ranked high between wetlands
Intolerant (flow & flow related water quality)	3	2.5	More than 50% of taxa dependent on permanent water
Species/taxon richness	3	3.5	695 taxa or 23% of taxa in basin
Wetland Habitats			
Diversity of types	3	3	15 of a possible 19 wetlands ecotypes present in the Sudd
Refugia	2.5	2	Vast slow water zones and backwaters for birds, fish, invertebrates and amphibians
Sensitivity to flow changes	1.5	2.5	more of the wetland is flood dependent than the permanent swamps, although there are no steep gradients
Sensitivity to flow related water quality changes	1	1.5	Low confidence but it is assumed to be low due to the magnitude of the system

Migration route/corridor (instream & riparian)	4	3.5	19 migratory bird species and tiang and white-eared kob migrations – has high basin ranking
Importance of conservation & natural areas	4	4	Contains National Park, and vastly untouched with high ecological category and integrity
MEDIAN	3		
EIS EVALUATION	HIGH		

6.3 Wetland Health

Land use data and habitat and biodiversity information was used to assess the overall health of the Sudd wetland complex. WetHealth Level 1 (Macfarlane *et al.,* 2009) will be used to assess hydrology, geomorphology and vegetation of the entire wetland as a single HGMs according to the newest delineation generated from this project (see section on delineation). WET-Health is a tool designed to assess the health or integrity of a wetland (Macfarlane *et al.*, 2009). Wetland health is defined as a measure of the deviation of wetland structure and function from its natural reference condition. This technique attempts to assess hydrological, geomorphological and vegetation health. It is a modular approach that uses:

- An impact-based approach for those activities that do not produce clearly visible responses in wetland structure and function. The impact of irrigation or afforestation in the catchment, for example, produces invisible impacts on water inputs. This is the main approach used in the hydrological assessment.
- An indicator-based approach for activities that produce clearly visible responses in wetland structure and function such as the presence of gullies or alien species. This approach is mainly used in the assessment of geomorphological and vegetation health.

The vegetation component of WET-Health is often used as a quick measure of wetland ecological status and assumes that vegetation structure, composition and distribution adequately reflect recent impact regimes. The output score of the WetHealth tool is expressed as an ecological category, which has been defined in Table 4-2, for each driver component (hydrology, geomorphology and vegetation) as well as an overall health score (category) which represents the ecological status of the wetland being assessed, and may thus also serve a limited monitoring purpose.

Results of the WetHealth assessment for the Sudd as a whole (Figure 6-1 indicates the delineated area used for the assessment) indicate that the hydrology is in a category C, the geomorphology a category A and the vegetation a category B. Overall the ecological category for the Sudd is a B (score of 1.41). This equates to a system that is largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. The main impacts are grazing, agriculture and settlements, although these occupy or disturb a small proportion of the vast wetland.

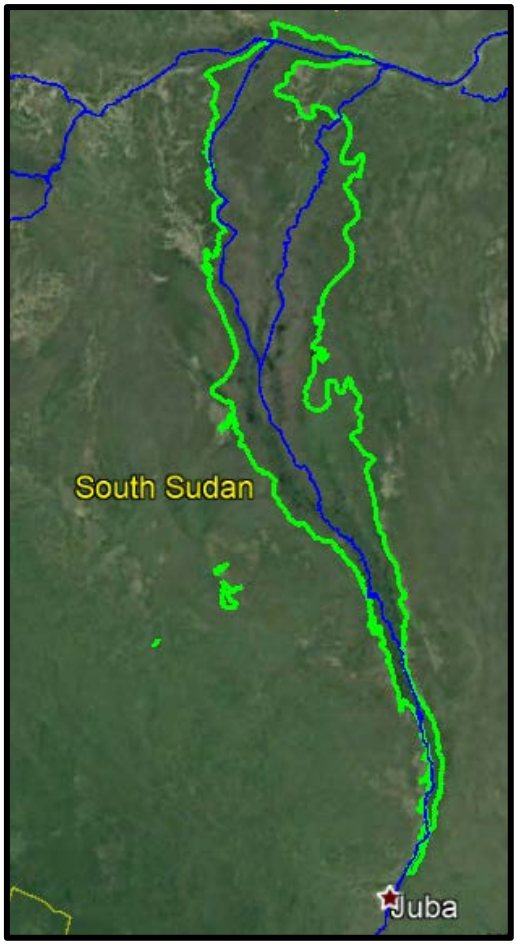


Figure 6-1. Delineated area of the Sudd

6.4 Linking Biodiversity to Flow

The ultimate aim of this project is to be able to relate biodiversity value to flow and in particular flow scenarios, so that water resources management options might be considered. This also needs to explicitly take human use of the wetland into consideration, largely packaged as ecosystem services. This requires the definition of flow dependencies of habitats and indicators in terms of their hydraulic and hydrological niche preferences and linkages of these preferences to changes in flow. These linkages from autecological preferences all the way to management, biodiversity and services in response to flow scenarios needs common currency for interactions. It is suggested here, that in this project, land use be such a common currency because not only do the categories adequately represent flow sensitive habitats (and therefore also their biota and requirements) but they can also be linked to ecosystem services. Land use data are also aerial, so they are easily collected and therefore lend themselves well to management scenarios and monitoring in real time. Figure 6-2 attempts to visually represent the proposed flow of such casual linkages and feedbacks.

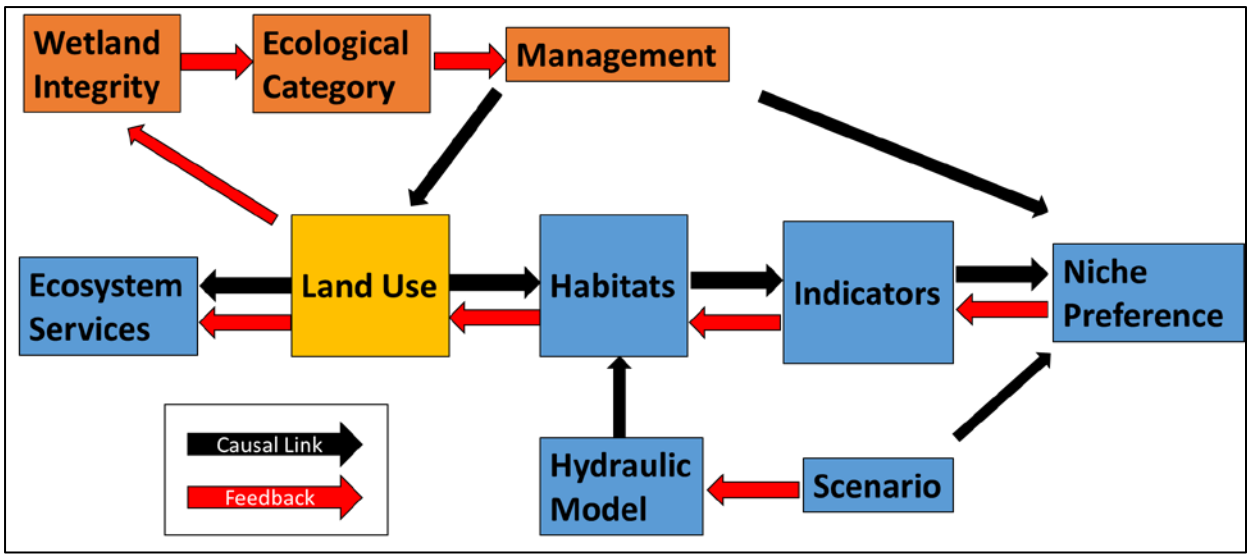


Figure 6-2. Flow chart of system links and feedbacks

The dominant habitat types and ecotypes in the Sudd are outlined above in Table 6-2. Only the types that are flow dependent and sensitive to changes in flow are pertinent here. This includes four main habitats: open water vegetation (aquatic and fringe), Papyrus marsh, Reed beds (*Phragmites*) and river flooded grassland (Toich). These can be discerned in satellite data and therefore relate directly to the land use data. Each habitat type, in turn is represented by a dominant indicator or suite of indicators, each with a set of hydraulic and hydrological niche preferences. These links between habitats, land use and indicators are shown in Table 6-5 and the respective niche preferences and responses in Table 6-6.

Table 6-5. Links between Habitats, land use and indicators

Habitat Type	Land Use Category	Indicators (link to biodiversity)
Open water Vegetation (Aquatic)	Water	Indicators of this habitat include floating vegetation such as water hyacinth (*Eichornia crassipes*), water fern (*Azolla nilotica*) and water lettuce (*Lemna giba*), but these don't make good indicators of flow, so rooted species are preferred. These include water Lily (*Nymphae lotus), Potamogeton, Trapa* and *Ceratophyllum* species.
Papyrus Marsh (permanent)	Papyrus	Fringe Vegetation characterised by bands of *Vossia cuspidata* or *Echinochloa stagnina*, usually followed by notable zones of Papyrus (*Cyperus papyrus*) and *Typha domingensis*.
Reed beds (Phragmites)	Reeds	A zone beyond the Papyrus but be included at times and dominated *by Phragmites karka* (reeds). *Oryza barthii* also present.
River flooded Grassland	Wetland Grasses	The tall grasses are dominated by *Phragmites, Sorghum, Hyparrhenia* and *Setaria* species as well as *Oryza* and *Echinochloa*. Two grassland types are recognized. These are wild rice grassland dominated by *Oryza longistaminata* and *Echinochloa* grassland dominated by *Echinochloa pyramidalis*.

These hydraulic and hydrological niche preferences, which were outlined in detail by Sutcliffe (2009), and responses provide a direct link to water depth distribution across the floodplain via the hydraulic model outputs (see WP2), and can therefore be used to assess flow scenarios and their influence on wetland habitats and overall biodiversity.

Table 6-6. Links between habitats, land use and niche preference

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
Open water Vegetation (Aquatic)	Water	Indicators of this habitat include floating vegetation such as water hyacinth (Eichornia crassipes), water fern (Azolla nilotica) and water lettuce (Lemna giba), but these don't make good indicators of flow, so rooted species are preferred. These include water Lily (Nymphae lotus), Potamogeton, Trapa and Ceratophyllum species.	> 1.3m up to 2.5m for rooted species, not applicable to floating species, these deep-rooted species frequently occur on the deep side of Papyrus	slow (<0.3m/s)	permanent, slow flowing	Year-round	1) Aquatic vegetation 2) Fish diversity in the Sudd is impressive and appears to be a response to the favourable environmental conditions for recruitment and survival offered by the mosaic of habitat types, but especially limnophylic and potamodromous fish species 3) Aquatic invertebrates 4) Water bird nesting sites (floating) 5) Piscivorous birds	1) If flows are too fast these species become vulnerable to loss of parts or individuals due to scour, flows faster than 0.3m/s over prolonged periods will reduce their occurrence 2) The deeper water gets the more limiting light becomes to rooted aquatic plants. Below 2.5m for prolonged periods will reduce occurrence or result in total loss. If water clarity is compromised the critical depth becomes less than 2.5m

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
Papyrus Marsh (permanent)	Papyrus	Fringe Vegetation characterised by bands of Vossia cuspidata or Echinochloa stagnina, usually followed by notable zones of Papyrus (Cyperus papyrus) and Typha domingensis.	Can be various but Papyrus generally limited by prolonged flooding below 1.5m, although can withstand much deepr flooding for shorter periods; optimal depth from 1.5m to 1.3m, shallower than 1.3m mixed stands co-occur with reeds	slow (<0.3m/s)	permanent, slow flowing	Year-round	1) The fish communities in the wetland are comprised of 31 Siluroids, 16 Characoids, 14 Cyprinoids, 11 Momyrids, 8 Cichlids, and 7 Cyprinodonotids. Fish species whose life-cycles start and end in the wetland belong to the following genera: Polypterus, Heterotis, Hyrocymus, Alestes, Distichordus, Citharinus, Labeo, Sarotherodon, Synodontis, Auchenoglaris, Oreochromis, Ctenopoma, Clarias and Protopterus. 2) Marsh dependent	1) The levels of the boundary between the shallow-flooded species and deep-flooded species are related to the maximum depth of flooding. The presence or absence of papyrus indicates that the range of flooding is important. 2) Depths >1.5m and for prolonged periods (near permanent) tend to be faster flowing and the presence of Papyrus becomes limiting. 3) Other fringe vegetation is likely to be lost before Papyrus. 4) If water depths are reduced for prolonged

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
							birds such as the Shoebill, Basra reed warbler, Yellow Papyrus Warbler, Papyrus Gonolek and Papyrus Canary. 3) The tall plants provide a framework for climbers such as Luffa cylindrical and Vigna luteola. 3) Papyrus-dependent insects such as the Papyrus Wisp (endangered).	periods, or permanently, fringe vegetations and Papyrus will encroach towards the channel, as will reeds which will begin to encroach into existing Papyrus beds.

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
Reed beds (Phragmites)	Reeds	A zone beyond the Papyrus but be included at times and dominated by Phragmites karka (reeds). Oryza barthii also present.	0.5-1.3m (optimal range for distribution but can withstand deeper flooding for shorter periods)	slow (<0.3m/s)	spans both permanently and seasonally flooded zones	Wet season (June to Oct)	1) Several endangered animal species are found in the Sudd namely, Cheetah, White addax, Grévy's zebra, Nile lechwe, and African wild dog. Other swamp dwelling mammals include Hippoptamus, Sitatunga, Marsh Mongoose. Elephant make local movements in the wetlands as the water recedes. Migratory mammals depend on the wetland for their dry season grazing. The Sudd is one of the most important wintering grounds in Africa for Palaearctic	1) Water depth of 0.5-1.3m is the optimal range for distribution but can withstand deeper flooding for shorter periods. 2) Deeper depths for prolonged periods will cause die off and encroachment laterally towards higher ground, into existing grassland. 3) Shallower depth for prolonged periods will cause lower densities and possible die off on the upper side and encroachment towards the channel and into Papyrus on the channel side.

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
							migrants, providing essential habitats for millions of migrating birds such as Pelecanus onocrotalus, Balearica pavonina, Ciconia ciconia and Chlidonias nigra. The Shoebill avoids the main channels of the swamp and very tall vegetation. The Shoebill prefers the smaller channels and pools specifically those surrounded by Typha. It mostly eats air-breathing fish which the Shoebill ambushes when they come up for air.	

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
River flooded Grassland	Wetland Grasses	The tall grasses are dominated by Phragmites, Sorghum, Hyparrhenia and Setaria species as well as Oryza and Echinochloa. Two grassland types are recognized. These are wild rice grassland dominated by Oryza longistaminata and Echinochloa grassland dominated by Echinochloa pyramidalis.	0 in the dry season, optimally 0.5 - 1.1m during floods, but up to 1.3m, steep decline beyond 1.5m	slow, not flowing	seasonal, about 70-90 days in the wet season; max flood up to 10 days at 1.3m and 1 month at 1.18m	Wet season (June to Oct)	1) Grassland can be divided into seasonally river-flooded grassland and seasonally rain-flooded grassland. 2) Seasonal flooding enables the growth of grasses such as Sorghum sudanica, Echinochloa spp. and Oryza longistaminata, wild rice-grass. This grassland is known as the 'toich'. Where the water is deeper the Oryza longistaminata is dominant, but needs several months (mostly up to 3) of surface water in order to flower. Echinochloa pyramidalis is the dominant grass	1) Loss of annual floods will result in loss of productivity, altered species composition and encroachment by alien and terrestrial species. 2) Flood duration of 70-90 days is important to productivity and reproduction (plants and fish), shorter periods will result in reduced productivity, failure of reproduction and shrinkage of floodplains which are also important to Sitatunga, and Nile lechwe, which migrate between the swamps and toich, ie follow changing water levels and vegetation. 2)

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
							with Sporobolus pyramidalis, Digitaria debilis and Desmodium hirtum where the flood water is shallower. 4) Many potamodromous fish species are dependent on wetland habitats for overall population wellbeing and especially for recruitment during flooding. Notable among these groups are the limnophilic species such as the Cyprinids (includes the carps, the true minnows, and their relatives, e.g. the barbs and barbels), Cichlids and Siluriformes	potamodromous fish species that are dependent on flooding seasonality and duration for recruitment and overall population health will be severely hampered if floods are absent, of too short a duration, or in the wrong season.

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
							(catfish). Fish migration includes both lateral and longitudinal en mass movement, can be extensive and is always flood dependent, highlighting the importance of river / wetland connectivity and interconnectivity as well as the conservation of critical hydrological flow parameters. 5) Nile Lechwe are endemic to the Sudd and their movements are related to the flood cycle. It does not live in the swamp but follows the waterline of the river flooded grasslands. White-	

Indicator Guild	Land Use Category	Indicators	Niche Preference				Biodiversity Link	Response
			Water depth preference (determined at peak flood)	Flow Vel preference	Flood duration	Seasonality		
							eared Kob make large migrations in the seasonal grasslands, they feed in the grasslands mainly on Hyparrhenia and associated grasses.	

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Annex 1 – Species list – Presence (indicated by #1) per wetland / wetland complex.

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Acacia seval												1
Acacia seyal												1
Acanthocercus atricollis							1					
Acanthocercus cyanogaster							1					
Acanthodactylus boskianus									1			
Accipiter badius							1					
Accipiter brevipes	1		1	1					1			1
Accipiter melanoleucus			1	1		1	1	1	1	1	1	
Accipiter minullus	1			1	1	1	1	1	1	1	1	1
Accipiter nisus									1			
Accipiter ovampensis							1					
Accipiter rufiventris							1					
Accipiter tachiro					1	1	1	1		1	1	
Accipiter toussenelii						1	1			1		
Aciagrion africanum						1	1			1		
Acinonyx jubatus							1					
Acisoma inflatum	1		1		1	1	1	1		1	1	1
Acisoma trifidum					1	1	1	1		1	1	
Acisoma variegatum					1	1	1	1		1	1	1
Acmella uliginosa							1	1				
Acomys muzei							1					
Acomys wilsoni							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Aconyx jub	1											
Acrocephalus arundinaceus	1		1	1	1	1	1	1	1	1	1	1
Acrocephalus gracilirostris					1	1	1	1	1		1	1	1
Acrocephalus griseldis			1					1		1			1
Acrocephalus melanopogon										1			
Acrocephalus palustris			1	1			1			1			
Acrocephalus rufescens	1				1	1		1			1	1	1
Acrocephalus schoenobaenus	1		1	1	1	1	1	1	1	1	1	1	1
Acrocephalus scirpaceus	1		1	1	1	1	1	1	1	1	1	1	1
Acrocephalus stentoreus										1			
Acrotylus patruelis								1					
Actitis hypoleucos	1		1	1	1	1	1	1	1	1	1	1	1
Actophilornis africanus	1		1	1	1	1	1	1	1	1	1	1	1
Adenostemma caffrum					1	1		1	1		1	1	
Aegilops ventricosa										1			
Aepyceros melampus								1					
Aeschynomene elaphroxylon								1					
Aeschynomene indica	1				1								1
Aethiomastacembelus frenatus								1					
Aethiothemis coryndoni						1		1			1		
Aethiothemis solitaria	1				1	1		1	1		1	1	1
Aethomys hindei								1					
Aethomys kaiseri								1					
Aethriamanta rezia	1				1	1		1	1		1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Afrana angolensis							1					
Africallagma elongatum				1	1	1	1	1		1	1	
Africallagma glaucum				1	1		1	1		1	1	
Africallagma pseudelongatum				1	1		1	1		1	1	
Africallagma subtile		1	1	1	1		1	1		1	1	1
Africallagma vaginale				1	1		1			1		
Africanogyrus coretus						1			1	1		
Afrixalus fulvovittatus							1					
Afrixalus laevis										1		
Afrixalus leucostictus										1		
Afrixalus orophilus										1		
Afrixalus osorioi					1		1			1	1	
Afrixalus quadrivittatus			1	1	1		1	1		1	1	1
Afroaeschna scotias				1	1		1			1		
Afrodrepanus marshalli							1					
Afromastacembelus frenatus											1	
Afromastacembus trenatus							1					
Afronemacheilus abyssinicus						1						
Afrotridactylus usambaricus		1		1	1		1	1		1	1	1
Agama finshi							1					
Agama mwanzae							1					
Agapornis fischeri							1					
Agapornis pullarius							1					
Agopornis fischeri							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Agricola pallidus							1					
Agriocnemis exilis	1		1		1	1	1	1		1	1	1
Agriocnemis forcipata	1									1		1
Agriocnemis gratiosa	1				1	1	1	1		1	1	1
Agriocnemis inversa			1	1	1	1	1	1		1	1	1
Agriocnemis maclachlani						1	1	1		1	1	
Agriocnemis palaeforma					1	1	1			1		
Agriocnemis victoria					1	1	1	1		1	1	
Agriocnemis zerafica	1		1	1		1	1			1		1
Agrostis stolonifera									1			
Alaemon alaudipes									1			
Alauda arvensis									1			
Alcedo atthis									1			
Alcedo quadribrachys					1	1	1			1		
Alcedo semitorquata			1		1		1	1				
Alcelaphus buselaphus			1				1					
Alcelaphus buselaphus tora				1								
Alestes				1								
Alestes baremose										1		
Alestes baremoze			1	1		1				1		1
Alestes dentex	1		1	1		1				1		1
Alestes jacksonii											1	
Alestes macrolepidotus												1
Alestes macrophthalmus										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Alestes sadleri											1	
Alethe castanea							1					
Alisma gramineum									1			
Alisma plantago-aquatica	1		1	1	1	1	1	1	1	1	1	1
Allocnemis nigripes	1					1		1	1		1	1
Allocnemis pauli					1	1		1	1		1	
Allocnemis superba					1	1		1	1		1	
Aloe lateritia								1				
Alopochen aegyptiaca	1		1	1	1	1	1	1	1	1	1	1
Alopochen aegypticus								1				
Alosa fallax									1			
Alternanthera sessilis	1		1	1	1	1	1	1	1	1	1	1
Amadina fasciata									1			
Amandava amandava									1			
Amandava subflava	1		1		1	1	1	1		1	1	1
Amandina fasciata				1								
Amaranthus spinosa											1	
Amaurornis flavirostra										1		
Amaurornis flavirostris							1					
Amaurornis marginalis					1	1		1		1	1	
Amblyodipsas unicolor							1					
Amblyospiza albifrons			1		1	1		1		1	1	1
Amietia desaegeri										1		
Amietia nutti						1	1			1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Amietia ruwenzorica										1		
Amietophrynus gutturalis							1					
Amietophrynus kisoloensis							1					
Amietophrynus maculatus							1					
Ammomanes cinctura									1			
Ammomanes deserti									1			
Ammoperdix heyx									1			
Amnirana albolabris					1	1	1			1	1	
Amnirana galamensis	1		1		1	1	1	1		1	1	1
Amphilius cf. jacksonii							1					
Amphilius jacksonii										1		
Amphilius lujani							1				1	
Amphilius uranoscopus					1	1	1			1	1	
Anabathmis reichenbachii										1		
Anaciaeschna triangulifera			1		1	1	1	1		1	1	
Anagallis kochii										1		
Anaplectes leuconotos							1					
Anas acuta	1		1	1	1	1	1	1	1	1	1	1
Anas capensis							1	1			1	
Anas clypeata									1			
Anas crecca			1	1	1	1	1	1	1	1	1	1
Anas cypeata				1								
Anas erythrorhyncha	1		1	1	1	1	1	1	1	1	1	1
Anas penelope									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Anas platyrhynchos				1					1			
Anas querquedula				1			1		1			
Anas sparsa	1		1	1	1	1	1	1		1	1	1
Anas undulata			1		1	1	2	1		1	1	1
Anastomus lamelligerus	1		1	1	1	1	1	1	1	1	1	1
Anax chloromelas					1		1	1		1	1	
Anax ephippiger	1		1	1	1	1	1	1	1	1	1	1
Anax imperator	1		1	1	1	1	1	1	1	1	1	1
Anax speratus	1		1	1	1	1	1	1		1	1	1
Anax tristis					1	1	1	1		1	1	1
Andersonia leptura			1									1
Angraecum distichum							1					
Anguilla anguilla									1			
Anhinga melanogaster							1					
Anhinga rufa	1		1	1	1	1	1	1	1	1	1	1
Anisotes macrophyllus							1					
Anoedopoda lamellata							1					
Anomalospiza imberbis			1			1	1	1			1	1
Anomalurus derbianus							1					
Anquilla anquila							1					
Anthoscopus caroli							1					
Anthoscopus punctifrons				1								1
Anthoscopus sylviella							1					
Anthreptes longuemarei	1					1	1			1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Anthreptes orientalis			1			1		1		1		1
Anthreptes seimundi							1					
Anthreptes tephrolaemus							1					
Anthropoides virgo	1		1	1					1			1
Anthus brachyurus							1					
Anthus campestris									1			
Anthus cervinus	1		1	1	1	1	1	1	1	1	1	1
Anthus cinnamomeus							1		1			
Anthus leucophrys							1					
Anthus pratensis									1			
Anthus richardi									1			
Anthus similis							1		1			
Anthus spinoletta									1			
Anthus trivialis							1					
Anubias gilletii										1		
Aonyx capensis	1		1	1	1	1	1	1		1	1	1
Aonyx congicus										1		
Apaarallactus jacksonii oweni subsp.nov.	1											
Apalis binotata							1					
Apalis cinerea							1					
Apalis flavida							1					
Apalis goslingi										1		
Apalis jacksoni							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Apalis karamojae							1					
Apalis nigriceps							1					
Apalis personata							1					
Apalis rufogularis							1					
Apaloderma narina							1					
Apaloderma vittatum							1					
Aparallactus lunulatus concolor	1											
Aparallactus lunulatus lunulatus	1											
Aphanius fasciatus									1			
Apium crassipes									1			
Apium graveolens									1			
Apium nodiflorum				1		1			1			
Aplocheilichthys atripinna							1					
Aplocheilichthys bukobanus					1	1	1	1		1	1	
Aplocheilichthys centralis					1	1	1	1		1	1	
Aplocheilichthys kingii			1									
Aplocheilichthys loati												1
Aplocheilichthys pumilus							1					
Aplocheilichthys vitschumbaensis						1	1			1		
Aplopelia larvata							1					
Aponogeton nudiflorus							1	1			1	
Aponogeton rehmannii					1		1	1			1	
Aponogeton stuhlmannii					1	1	1	1		1	1	
Aponogeton subconjugatus	1		1									1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Aponogeton vallisnerioides	1		1	1	1	1	1	1		1	1	1
Apus affinis							1					
Apus apus	1		1	1	1	1	1	1	1	1	1	1
Apus caffer							1					
Apus horus				1	1		1			1	1	
Apus niansae							1					
Apusaffinis				1								
Aquila africana							1					
Aquila heliaca			1	1					1		1	1
Aquila nipalensis							1		1			
Aquila pomarina									1			
Aquila rapax							1		1			
Aquila spilogaster							1					
Arantia fasciata							1					
Ardea alba	1		1	1	1	1	1	1	1	1	1	1
Ardea brachyrhyncha	1		1	1	1	1	1	1		1	1	1
Ardea cinerea	1		1	1	1	1	1	1	1	1	1	1
Ardea goliath	1		1	1	1	1	1	1	1	1	1	1
Ardea intermedia				1						1		
Ardea laralloides				1								
Ardea melanocephala	1		1	1	1	1	1	1	1	1	1	1
Ardea purpurea	1		1	1	1	1	1	1	1	1	1	1
Ardea ralloides							1					
Ardeola idae					1	1	1	1		1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Ardeola ralloides	1		1	1	1	1	1	1	1	1	1	1
Ardeola rufiventris					1	1		1	1		1	1	
Ardeotis arabs			1	1					1			1
Ardeotis kori				1			1					
Arenaria interpres									1			
Argya fulva									1			
Argya rubiginosa							1					
Arricanthis niloticus									1			
Arundo donax							1		1			
Arvicanthis niloticus							1					
Arvicanthis sp	1											
Arvicanthis zebra	1											
Ascolepis capensis			1	1	1	1	1	1	1		1	1	
Ascolepis elata	1		1	1	1		1						1
Ascolepis lineariglumis							1					
Asio capensis	1		1	1	1	1	1	1	1		1	1	1
Asio flammeus				1					1			
Asio otus									1			
Aspatharia chaiziana	1			1					1			1
Aspatharia divaricata							1					
Aspilia helianthoides					1	1		1	1		1	1	1
Astatoreochromis alluaudi					1	1		1	1		1	1	
Astatotilapia burtoni					1		1					
Astatotilapia nubila							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Atelerix albiventris							1					
Atelerix pruneri	1											
Atherina boyeri									1			
Atheris squamigera							1					
Atherurus africanus							1					
Atherurus centralis	1											
Atilax paludinosis	1						1					
Atilax paludinosus	1		1	1	1	1	1	1		1	1	1
Atimastillas flavigula			1		1	1	1			1	1	
Atoconeura aethiopica			1									
Atoconeura eudoxia					1	1	1			1	1	
Atoconeura kenya						1	1			1	1	1
Atoconeura pseudeudoxia					1	1	1			1		
Atopochen aegyptiacus				1								
Atractapsis irregularis							1					
Atractaspis irregularis	1						1					
Atractaspis microlepidota microlepidota	1											
Auchenoglanis biscutatus	1		1	1					1			1
Auchenoglanis occidentalis	1		1	1		1				1		1
Auchenoglaris												1
Aulacosiera granulata								1				1
Aviceda cuculoides							1					
Aythya ferina	1		1	1		1	1		1	1		1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Aythya fuligula	1		1	1		1	1			1		1	1	1
Aythya nyroca	1		1	1			1			1				1
Azolla nilotica				1	1	1		1	1	1	1			1
Azolla pinnata								1						
Azuragrion nigridorsum			1		1	1		1	1		1	1	1	1
Bachiaria					1									
Bacopa monnieri										1				
Baeopogon clamans											1			
Baeopogon indicator								1						
Bagrus				1										
Bagrus bajad	1		1	1			1			1	1			1
Bagrus degeni								1						
Bagrus docmac											1			
Bagrus docmak	1		1	1	1	1	1	1	1	1	1	1	1	1
Balaeniceps rex	1		1		1	1		1	1		1	1	1	1
Balanites aegyptiacus														1
Balanites aegyptiwca														1
Balearica pavonina	1		1	1			1							1
Balearica regulorum					1	1		1	1		1	1		
Bambusa vulgaris					1									
Barbus alluaudi											1			
Barbus alternialis												1		
Barbus altianalis								1						
Barbus amphigama												1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Barbus anema			1									
Barbus apleurogramma							1					
Barbus binny				1								
Barbus cercops							1				1	
Barbus humilis			1			1						
Barbus jacksonii							1				1	
Barbus kerstenii							1				1	
Barbus magdalenae							1					
Barbus neglectus							1					
Barbus neumayeri							1					
Barbus numayeri											1	
Barbus nyanzae							1				1	
Barbus paludinosus				1			1				1	
Barbus perince			1									
Barbus pleurogramma						1						
Barbus profundus							1					
Barbus radiatus							1					
Barbus stigmatopygus			1									1
Barbus tanapelagius						1						
Barbus trispilopleura							1					
Barbus yongei							1					
Bathmocercus rufus							1					
Batis erlangeri							1					
Batis minor										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Batis molitor							1					
Bdeogale crassicauda							1					
Bellamya capillata										1		
Bellamya constricta							1	1			1	
Bellamya phthinotropis							1					
Bellamya trochlearis							1				1	
Bellamya unicolor	1		1	1	1	1	1	1	1	1	1	1
Berachionus												1
Bias musicus							1					
Biomphalaria alexandria									1			
Biomphalaria choanomphala							1	1			1	
Biomphalaria smithi										1		
Biomphalaria stanleyi										1		
Biomphalaria sudanica	1		1	1						1		1
Bitis nasicornis							1					
Bleda syndactylus							1					
Bleda ugandae							1					
Blyxa aubertii					1		1	1			1	
Blyxa hexandra					1		1	1		1		
Boaedon lineatus lineatus	1											
Bocagia minuta	1				1	1	1	1		1	1	1
Boiga blandingii	1											
Bolboschoenus glaucus									1			
Bolboschoenus maritimus									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Borassus aethiopium				1								
Bostrychia carunculata						1						
Bostrychia hagedash	1		1	1	1	1	1	1	1	1	1	1
Bostrychia olivacea											1	
Bostrychia rara										1		
Bostrychinia carunculata						1						
Botaurus stellaris	1		1	1					1			1
Bothriochloa insculpta				1								
Botriochloa insculpta				1								
Brachiaria eruciformis									1			
Brachythemis impartita	1		1	1	1	1	1	1	1	1	1	1
Brachythemis lacustris	1		1		1	1	1	1	1	1	1	1
Brachythemis leucosticta	1		1		1	1	1	1	1	1	1	1
Brachythemis wilsoni	1		1							1		1
Bradinopyga cornuta				1	1		1	1		1	1	
Bradinopyga strachani	1		1		1	1	1	1		1	1	1
Bradornis comitatus							1					
Bradornis fuliginosus							1					
Bradornis microrhynchus							1					
Bradypterus baboecala						1						
Bradypterus carpalis				1	1		1			1	1	
Bradypterus centralis	1		1	1			1			1	1	1
Bradypterus graueri										1		
Bradypterus lopezi							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Bragus docmac											1	
Brevimyrus niger	1		1	1								1
Brillantaisia lamium					1	1		1		1		
Brillantaisia owariensis					1	1		1	1		1	
Brillantaisia soyauxii										1		
Brycinus bimaculatus										1		
Brycinus grandisquamis										1		
Brycinus imberi										1		
Brycinus jacksonii					1	1		1	1		1	
Brycinus macrolepidotus	1		1	1		1	1			1		1
Brycinus nurse	1		1	1		1		1		1		1
Brycinus sadleri					1	1		1	1	1	1	
Bryconaethiops microstoma										1		
Bubalornis niger							1					
Bubo africanus							1		1			
Bubo ascalaphus				1					1			
Bubo lacteus							1					
Bubulcus ibis	1		1	1	1	1	1	1	1	1	1	1
Buccanodon duchaillui							1					
Bucorvus abyssinicus				1								
Bucorvus leadbeateri					1		1				1	
Bufo gutturalis							1					
Bufo kassasii									1			
Bufo steindachneri							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Bufo vitattus							1					
Bufotes boulengeri									1			
Bugeranus carunculatus						1						
Bulbostylis clarkeana			1	1	1	1	1	1	1	1	1	
Bulbostylis schoenoides			1	1	1	1	1	1	1	1	1	
Bulbostylis trabeculata					1	1		1	1	1	1	1
Bulinus africanus					1	1	1	1		1	1	
Bulinus browni											1	
Bulinus forskalii	1		1	1		1	1	1	1		1	1
Bulinus globosus	1		1	1	1	1	1	1	1	1	1	1
Bulinus nasutus					1	1		1	1			
Bulinus productus						1		1	1		1	
Bulinus reticulatus			1				1	1			1	
Bulinus truncatus	1		1	1	1	1	1	1	1	1	1	1
Buphagus africanus	1			1	1		1	1		1	1	1
Buphagus erythrorhyncus							1					
Buphagus erythrorynchus			1		1		1	1			1	
Burhinidae				1								
Burhinus capensis							1					
Burhinus oedicnemus	1		1	1		1	1		1			1
Burhinus senegalensis	1		1	1			1		1	1		1
Burhinus vermiculatus					1	1		1	1	1	1	
Burihnus capensis				1								
Burnupia caffra					1	1	1	1	1	1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Burnupia stuhlmanni					1		1				1	
Bustastur rufipennis				1								
Butastur rufipennis	1		1	1		1	1	1		1	1	1
Buteo augur							1					
Buteo auguralis							1					
Buteo buteo					1	1	1	1	1	1	1	
Buteo rufinus									1			
Butorides striata	1		1	1	1	1	1	1	1	1	1	1
Bycanistes bucinator							1					
Bycanistes subcylindricus							1					
Cacosternum boettgeri						1						
Cacosternum plimptoni							1					
Caecomastacembelus frenatus							1					
Caladris melanotos							1					
Caladris minuta							1					
Calamonastes undosus							1					
Calamonastides gracilirostris				1			1	1		1	1	
Calandrella brachydactyla									1			
Calandrella cinerea							1					
Calherodius leuconotus			1	1	1		1	1		1	1	
Calidris alba									1			
Calidris alpina	1			1					1			1
Calidris canutus									1			
Calidris falcinellus									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Calidris ferruginea	1		1	1	1	1	1	1	1	1	1	1
Calidris minuta	1		1	1	1	1	1	1	1	1	1	1
Calidris pugnax	1		1	1	1	1	1	1	1	1	1	1
Calidris temminckii	1		1	1	1	1	1	1	1	1	1	1
Camaroptera brachyura	1		1	1	1	1	1	1		1	1	1
Camaroptera brachyuran				1								
Camaroptera brevicaudata										1		
Camaroptera superciliaris							1					
Camaroptera toroensis							1					
Campephaga flava							1					
Campephaga phoenicea							1					
Campephaga quiscalina							1					
Campethera abingoni							1					
Campethera bennettii							1					
Campethera cailliautii							1		1			
Campethera caroli							1					
Campethera nivosa							1					
Campethera nubica				1			1		1			
Canirallus oculeus										1		
Canis adustus	1		1	1	1	1		1	1		1	1	1
Canis aureus									1			
Canis lupaster							1					
Canis mesomelas							1					
Caprimulgus aegyptius									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Caprimulgus clarus							1					
Caprimulgus climacurus	1		1	1			1		1			1
Caprimulgus europaeus							1		1			
Caprimulgus eximius									1			
Caprimulgus fossii				1			1	1		1	1	
Caprimulgus fraenatus							1					
Caprimulgus inornatus							1					
Caprimulgus longipennis							1					
Caprimulgus natalensis	1		1		1	1	1			1		1
Caprimulgus nubicus									1			
Caprimulgus pectoralis							1					
Caprimulgus tristigma							1					
Caprimulgus vexillarius				1	1		1			1		1
Cara dina										1		
Caracal aurata							1					
Caracal caracal	1						1					
Cardioglossa leucomystax										1		
Carduelis carduelis									1			
Carduus nyassanus	1		1	1	1	1	1	1		1	1	1
Caretta caretta									1			
Carex acutiformis				1	1		1	1		1	1	
Carex bequaertii			1	1	1	1	1	1		1	1	
Carex conferta				1	1	1	1	1		1	1	
Carex distans									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Carex divisa									1			
Carex erythrorrhiza			1	1	1	1	1	1		1	1	1
Carex extensa									1			
Carex lycurus					1		1					
Carex monostachya			1									
Carex runssoroensis						1		1	1		1	1	
Carex simensis						1		1	1			1	
Caridina nilotica	1		1	1	1	1	1	1	1	1	1	1	1
Caridina togoensis	1		1	1	1	1		1		1	1	1	1
Carpha angustissima					1					1		
Carpha eminii										1		
Carpospiza brachydactyla									1			
Cassina senegalensis											1	
Catantops tanganus							1					
Caustus rhombeatus	1											
Causus lichtensteini							1					
Causus lichtensteinii	1											
Causus resimus	1						1					
Cayratia ibuensis												1
Ceblepyris caesius					1					1	1	
Ceblepyris pectoralis							1					
Cecropis abyssinica	1		1		1	1	1	1	1		1	1	1
Cecropis daurica	1		1	1	1	1	1	1	1	1	1	1	1
Cecropis semirufa					1	1		1	1		1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Cecropis senegalensis	1			1	1	1	1	1		1	1	1
Centropus cupreicaudus					1							
Centropus grillii	1		1		1	1		1	1		1	1	1
Centropus leucogaster										1		
Centropus monachus			1	1	1	1	1	1		1	1	1
Centropus senegalensis	1		1	1	1	1	1	1	1	1	1	1
Centropus superciliosus	1		1	1	1	1	1	1	1	1	1	1
Centrostachys aquatica	1		1	1	1	1	1	1	1	1	1	1
Cephalophinae							1					
Cephalophus										1		
Ceratophallus concavus								1				
Ceratophallus crassus								1				
Ceratophallus faini										1		
Ceratophallus kigeziensis						1		1		1		
Ceratophallus kisumiensis								1			1	
Ceratophallus natalensis					1	1	1	1	1	1	1	
Ceratophallus subtilis								1			1	
Ceratophyllum demersum						1		1		1	1	1
Ceratophyllum muricatum	1		1	1	1	1	1	1	1	1	1	1
Ceratotherium simum								1				
Cercococcyx mechowi								1				
Cercopithecus aethiops	1		1	1			1		1			
Cercopithecus ascanius								1				
Cercopithecus mitis								1				

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Cercopithecus mitis	1											
Cercopithecus neglectus			1				1			1	1	
Cercopithecus neglectus	1											
Cercotrichas galactotes				1		1			1			
Cercotrichas hartlaubi							1					
Cercotrichas leucophrys							1					
Cercotrichas podobe									1			
Ceriagrion bakeri					1		1			1		1
Ceriagrion corallinum				1	1		1	1		1	1	1
Ceriagrion glabrum	1		1	1	1	1	1	1		1	1	1
Ceriagrion kordofanicum				1	1		1	1		1	1	1
Ceriagrion platystigma				1	1		1			1	1	
Ceriagrion suave	1		1	1	1	1	1	1		1	1	1
Ceriagrion varians										1		
Ceriagrion whellani				1	1		1	1		1	1	
Ceriops tagal							1					
Ceryle rudis	1		1	1	1	1	1	1	1	1	1	1
Ceuthmochares aereus				1	1		1	1		1	1	
Chaerephon ansorgei							1					
Chaerephon bemmeleni							1					
Chaerephon bivittatus							1					
Chaerephon chapini							1					
Chaerephon major							1					
Chaerephon pumilus	1						1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Chalcides sepsoides									1			
Chalcomitra amethystina							1					
Chalcomitra rubescens							1					
Chalcomitra senegalensis							1					
Chalcostephia flavifrons	1		1		1	1	1	1		1	1	1
Chamaeleo (Triceros) ellioti							1					
Chamaeleo africanus				1					1			1
Chamaeleo dilepis							1					
Chamaeleo gracilis							1					
Chamaeleo gracillis							1					
Chamaeleo laevigatus	1		1	1	1	1	1	1		1	1	1
Chamaeleo quilensis							1					
Chamaetylas poliocephala							1					
Chambardia bourguignati					1	1	1	1		1	1	
Chambardia rubens	1		1	1		1	1	1	1		1	1
Chambardia trapezia					1		1	1		1	1	
Chambardia wahlbergi	1		1	1		1						1
Chambardia wissmanni										1		
Charadrius alexandrinus			1	1		1			1			
Charadrius asiaticus	1		1	1	1	1	1	1	1	1	1	1
Charadrius dubius	1		1	1	1	1	1	1	1	1	1	1
Charadrius forbesi	1									1		1
Charadrius hiaticula	1		1	1	1	1	1	1	1	1	1	1
Charadrius leschenaultii									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Charadrius marginatus										1		
Charadrius pecuarius	1		1	1	1	1	1	1	1	1	1	1
Charadrius tricollaris				1	1	1	1	1		1	1	
Chelaethiops bibae												1
Chelaethiops bibie			1	1								1
Chelictinia riocourii									1			
Chelon ramada									1			
Chelonia mydas									1			
Chiloglanis cf. somereni							1					
Chiloglanis niloticus			1									1
Chiloglanis somereni				1			1	1			1	
Chiromantis petersi							1				1	
Chiromantis petersii							1	1			1	
Chiromantis rufescens					1		1			1		
Chlidonias hybrida	1		1	1	1	1	1	1	1	1	1	1
Chlidonias hybridus							1					
Chlidonias leucopterus	1		1	1	1	1	1	1	1	1	1	1
Chlidonias niger									1			1
Chloris gayana				1								
Chlorocebus pygerythrus							1					
Chlorocebus tantalus							1					
Chlorocichla laetissima							1					
Chlorocichla prigoginei										1		
Chlorocypha aphrodite										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Chlorocypha cancellata					1		1			1		
Chlorocypha curta				1	1		1			1	1	
Chlorocypha trifaria					1		1			1		
Chlorocypha victoriae					1		1			1		
Chloropeta gracili rostris										1		
Chloropeta gracilirostris							1				1	
Chlorophoneus bocagei							1					
Chlorophoneus nigrifrons							1					
Chlorophoneus sulfureopectus							1					
Chroicocephalus cirrocephalus									1			
Chroicocephalus ridibundus									1			
Chrysichthys auratus			1	1					1			1
Chrysochloris stuhlmanni							1					
Chrysococcyx caprius							1					
Chrysococcyx cupreus							1					
Chrysococcyx klaas							1					
Cichladusa arquata							1					
Cichladusa guttata							1			1		
Cichlid Haplochromis					1							
Cichlidae									1	1		
Ciconia abdimii	1		1	1	1	1	1	1	1	1	1	1
Ciconia ciconia	1		1	1	1	1	1	1	1	1	1	1
Ciconia episcopus				1				1				1
Ciconia microscelis	1		1	1	1	1	1	1		1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Ciconia nigra	1		1	1	1	1	1	1	1	1	1	1
Cinnyricinclus leucogaster	1		1	1	1	1	1	1	1	1	1	1
Cinnyris bifasciatus					1	1		1	1		1	1	
Cinnyris bisfasciatus								1					
Cinnyris bouvieri								1					
Cinnyris chloropygius								1					
Cinnyris cupreus	1		1		1	1	1	1	1		1	1	1
Cinnyris erythrocercus	1				1	1		1	1		1	1	1
Cinnyris mariquensis					1	1		1			1	1	
Cinnyris mediocris								1					
Cinnyris osea	1												
Cinnyris pulchellus										1	1		
Cinnyris reichenowi								1					
Cinnyris superbus						1		1	1		1	1	
Cinnyris venustus			1		1	1	1	1	1		1	1	
Circaetus cinerascens	1		1		1	1	1	1	1	1	1	1	1
Circaetus cinereus								1		1			
Circaetus gallicus										1			
Circaetus pectoralis								1					
Circus aeruginosus	1		1	1	1	1	1	1	1	1	1	1	1
Circus cyaneus										1			
Circus macrouros								1					
Circus macrourus	1		1	1	1	1	1	1	1	1	1	1	1
Circus pygargus	1		1	1	1	1	1	1	1	1	1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Circus ranivorus				1	1	1		1	1		1	1	1
Cisticola aberrans					1			1	1			1	
Cisticola angusticauda								1					
Cisticola anonymus										1			
Cisticola aridulus									1				
Cisticola ayresii								1					
Cisticola brachypterus		1		1		1	1	1	1		1	1	1
Cisticola cantans								1					
Cisticola carruthersi					1	1		1			1	1	
Cisticola chiniana								1					
Cisticola chubbi					1	1		1			1	1	
Cisticola erythrops			1	1	1	1	1	1	1		1	1	
Cisticola galactotes											1		
Cisticola hunteri									1			1	
Cisticola juncidis		1		1	1	1		1	1	1	1	1	1
Cisticola lateralis								1					
Cisticola lugubris							1						
Cisticola marginatus		1	1	1	1	1		1	1		1	1	1
Cisticola natalensis		1	1		1	1	1	1	1		1	1	1
Cisticola robustus					1		1	1			1	1	
Cisticola ruficeps		1	1	1							1		1
Cisticola tinniens												1	
Cisticola troglodytes		1	1	1		1	1				1		1
Cisticola woosnami								1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Citharinus				1								1
Citharinus cithatus										1		
Citharinus latus	1		1	1						1		1
Civettictis civetta	1		1	1	1	1	1	1	1	1		1
Civettictus civetta	1											
Cladium jamacanse							1				1	
Cladium mariscus					1	1	1	1	1	1	1	
Clamator glandarius							1					
Clamator jacobinus							1					
Clamator levaillantii	1		1	1	1	1	1	1	1	1	1	1
Clanga clanga				1			1		1			
Clanga pomarina							1					
Clariallabes petricola						1	1	1			1	
Clarias								1				
Clarias alluaudi					1	1	1	1		1		
Clarias anguillaris	1		1	1					1			1
Clarias carsonii							1					
Clarias dumerilii										1		
Clarias engelseni				1								
Clarias gariepinus	1		1	1	1	1	1	1	1	1		1
Clarias hilli										1		
Clarias lazera				1					1			
Clarias liocephalus					1	1	1	1		1	1	
Clarias mossambicus											1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Clarias sp2								1				
Clarias theodorae											1	
Clarias werneri					1	1	1	1		1	1	1
Clarotes laticeps	1			1								1
Cleopatra bulimoides	1		1	1					1	1		1
Cleopatra cridlandi							1				1	
Cleopatra guillemei					1		1	1			1	
Clytospiza monteiri							1					
Coccinia grandis												1
Coccopygia quartinia							1					
Coelatura aegyptiaca	1		1	1					1			1
Coelatura alluaudi							1	1			1	
Coelatura bakeri										1		
Coelatura cridlandi							1					
Coelatura hauttecoeuri							1	1			1	
Coelatura stuhlmanni										1		
Coleura afra							1					
Colius striatus							1			1		
Colobus angolensis							1					
Colobus guereza	1						1					
Colobus satanas						1						
Colomys goslingi						1	1			1	1	1
Coluber florulentus florulentus	1											
Columba arquatrix							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Columba guinea							1		1			
Columba livia									1			
Columba unicincta							1					
Commelina benghalensis							1					
Commelina spp.											1	
Comopithecus hamadryas		1										
Connochaetes					1			1				
Conocephalus iris							1					
Conocephalus maculatus							1					
Conraua beccarii						1						
Conyza clarenceana					1	1	1	1		1	1	1
Copera nyansana					1	1	1	1		1	1	
Copera sikassoensis						1	1			1		
Copris complexus							1					
Copris fallaciosus							1					
Copris wiesei							1					
Coptodon rendalli					1		1	1		1	1	
Coracias abyssinica				1								
Coracias abyssinicus		1	1	1		1	1	1	1	1		1
Coracias caudatus							1					
Coracias garrulus							1		1			
Coracias naevius							1					
Corbicula africana					1	1	1	1		1	1	
Corbicula fluminalis		1	1	1			1		1			1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Corvinella corvina							1					1
Corvus albicollis					1	1	1			1	1	
Corvus albus	1		1	1	1	1	1	1	1	1	1	1
Corvus capensis			1			1	1				1	1
Corvus corone									1			
Corvus rhipidurus	1		1	1		1			1			1
Corvus ruficollis				1					1			
Corvus splendens							1					
Corythaeola cristata							1					
Corythaixoides leopoldi							1					
Corythornis cristatus	1		1	1	1	1	1	1	1	1	1	1
Corythornis leucogaster					1		1			1		
Cosmopsarus unicolor							1					
Cossypha cyanocampter							1					
Cossypha heuglini							1			1		
Cossypha natalensis							1					
Cossypha niveicapilla							1					
Cossyphala niveicapilla				1								
Coturnix coturnix							1		1			
Coturnix delegorguei							1					
Crassocephalum picridifolium	1		1	1	1	1	1	1		1	1	1
Creatophora cinerea				1			1					
Crenigomphus hartmanni					1	1	1	1		1	1	
Crenigomphus renei	1		1		1	1	1	1		1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Crex crex	1		1	1	1	1	1	1	1	1	1	1
Crex egregia					1	1		1	1		1	1
Cricetomys ansorgei												
Cricetomys emini												
Cricetomys gambianus												
Crinifer zonurus												
Criniferoides leucogaster												
Criniger calurus												
Crithagra atrogularis												
Crithagra burtoni												
Crithagra citrinelloides			1				1				1	
Crithagra dorsostriata												
Crithagra frontalis					1	1					1	1
Crithagra koliensis					1	1					1	1
Crithagra mennelli												
Crithagra mozambica												
Crithagra reichenowi												
Crithagra striolata												
Crithagra sulphurata												
Crocidura flowerii									1			
Crocidura fuscomurina												
Crocidura hildegardeae												
Crocidura hirta												
Crocidura jacksoni												

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Crocidura littoralis							1					
Crocidura luna							1					
Crocidura maurisca							1			1		
Crocidura mutesae							1					
Crocidura nanilla							1					
Crocidura nigrofusca							1					
Crocidura olivieri							1					
Crocidura parvipes							1					
Crocidura roosevelti							1					
Crocidura selina					1		1			1		
Crocidura sericea	1											
Crocidura spp	1											
Crocidura stenocephala										1		
Crocidura thalia						1						
Crocidura turba							1					
Crocodylus niloticus	1		1	1	1	1	1	1		1		1
Crocothemis divisa	1		1		1	1		1		1	1	1
Crocothemis erythraea	1		1	1	1	1	1	1	1	1	1	1
Crocothemis sanguinolenta	1		1		1	1	1	1		1	1	1
Crocuta crocuta							1	1				
Cromeria nilotica			1									1
Crossandrella dusenii							1					
Crotaphopeltis degeni							1					
Crotaphopeltis hotamboeia							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Crotaphopeltis hotamboeia hotamboeia		1										
Cryptomys ochracea-cinereus		1										
Ctenopoma												1
Ctenopoma murerei											1	
Ctenopoma murie							1					
Ctenopoma muriei		1	1	1	1	1	1	1		1	1	1
Ctenopoma petherici		1	1	1								1
Cuculus canorus							1			1		
Cuculus clamosus							1					
Cuculus gularis							1					
Cuculus rochii							1					
Cuculus solitarius							1					
Culcasia falcifolia							1					
Curruca cantillans									1			
Curruca communis									1			
Curruca crassirostris									1			
Curruca curruca									1			
Curruca melanocephala									1			
Curruca mystacea									1			
Curruca nana									1			
Curruca nisoria									1			
Curruca ruppeli									1			
Curruca subalpina									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Cursorius cursor									1			
Cursorius somalensis									1			
Cursorius temminckii							1					
Cyanecula svecica				1		1			1			
Cyanochen cyanoptera						1						
Cyanomitra cyanolaema							1					
Cyanomitra olivacea							1					
Cyanomitra verticalis	1				1	1	1			1	1	
Cyclanorbis elegans			1	1								1
Cyclanorbis senegalensis			1	1								1
Cyclosorus interruptus					1							1
Cyclosorus striatus										1		
Cygnus olor									1			
Cympogon nardus					1							
Cyndodon dactylon											1	
Cyperus afroalpinus					1		1	1		1	1	
Cyperus alopecuroides	1			1	1		1	1	1		1	1
Cyperus amabilis	1		1	1	1	1	1	1		1	1	1
Cyperus articulatus				1	1	1	1	1	1	1	1	
Cyperus aterrimus			1	1	1	1	1	1		1	1	
Cyperus compressus					1	1	1	1	1	1	1	
Cyperus congensis							1					
Cyperus denudatus					1							
Cyperus difformis	1		1	1	1	1	1	1	1	1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Cyperus digitatus							1					
Cyperus fuscus									1			
Cyperus glaucophyllus	1				1	1		1	1	1	1	1
Cyperus grandibulbosus					1		1	1			1	
Cyperus kerstenii							1	1			1	
Cyperus latifolius							1				1	
Cyperus papyrus	1		1	1	1	1	1	1	1	1		1
Cyperus pectinatus					1							
Cyperus plateilema				1	1	1	1	1		1	1	
Cyperus pulchellus					1	1	1	1		1	1	
Cyperus pustulatus	1				1		1	1		1	1	
Cyperus reduncus			1	1	1	1	1			1		
Cyperus rotundus			1	1	1	1	1	1	1	1	1	1
Cyperus schimperianus	1		1	1	1	1	1	1		1	1	1
Cyphostema babuseti											1	
Cyphostema suaveolens											1	
Cyphostemma kilimandscharicum											1	
Cyprinid						1						
Cypsiurus parvus	1			1	1	1	1	1	1	1	1	1
Cyptochirus ambiguus							1					
Damaliscus corrigumtiang	1											
Damaliscus lunatus			1	1	1		1			1		
Damaliscus lunatus tiang	1				1							1
Damasonium bourgaei									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Daphnia barbata												1
Dasymys										1		
Dasymys incomtus					1	1	1	1	1	1	1	1
Dasymys montanus										1		
Dasypeltis scabra							1					
Dasypeltis scabra palmarum	1											
Dasypeltis scabra scabra	1											
Deckenia mitis							1	1			1	
Deleornis axillaris							1					
Delichon urbicum							1		1			
Dendocyna viduata							1					
Dendroaspis polylepis							1					
Dendroaspis polylepis polylepis	1											
Dendrocygna bicolor	1		1		1	1	1	1	1	1	1	1
Dendrocygna bicolour							1					
Dendrocygna viduata	1		1	1	1	1	1	1	1	1	1	1
Dendrohyrax arboreus							1					
Dendrohyrax dorsalis							1					
Dendromus insignis										1	1	
Dendromus kivu										1		
Dendromus mystacalis							1					
Dendroperdix sephaena						1	1	1		1		1
Dendropicos elliotii							1					
Dendropicos fuscescens			1		1	1	1	1		1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Dendropicos goertae							1					
Dendropicos griseocephalus				1						1		
Dendropicos namaquus							1					
Dendropicos obsoletus							1					
Dendropicos poecilolaemus							1					
Dendropicos xantholophus							1					
Deomys ferrugineus					1		1			1		
Desmocaris trispinosa										1		
Desmodium hirtum												1
Diaphanosoma excisum												1
Diastatomma selysi										1		
Dicentrarchus punctatus									1			
Diceros bicornis				1			1					
Dicliptera elliotii										1		
Dicrurus adsimilis				1			1			1		
Dicrurus ludwigii							1					
Dicrurus modestus							1					
Digitaria debilis												1
Dinemellia dinemelli	1		1				1	1				1
Diplacodes deminuta	1			1	1		1			1		1
Diplacodes lefebvrii	1		1	1	1	1	1	1	1	1	1	1
Diplacodes luminans	1		1		1	1	1	1		1	1	1
Dipnoi										1		
Dischistocalyx hirsutus										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Dispholidus typus	1											
Dispholidus typus kivensis							1					
Distichodus				1								
Distichodus brevipinnis			1	1		1						
Distichodus engycephalus			1	1								
Distichodus niloticus	1		1	1						1		1
Distichodus rostrata												1
Distichodus rostratus			1	1		1				1		1
Dnopherula richardsi							1					
Dologale dybowski	1											
Dologale dybowskii							1					
Drepanorhynchus reichenowi							1					
Dromophis lineatus							1					
Dromophis lineatus	1											
Dromphis bicolour										1		
Drymocichla incana	1				1					1		1
Dryoscopus angolensis							1					
Dryoscopus cubla							1					
Dryoscopus gambensis							1					
Duberria lutrix							1					
Dyaphorophyia ansorgei							1					
Dyaphorophyia castanea							1					
Dyaphorophyia jamesoni							1					
Echinochloa haploclada												1

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Echinochloa pyramidalis											1	1
Echinochloa pyramidalis							1					1
Echinochloa scabra							1					
Echinochloa stagnina												1
Eclipta prostrata					1	1		1		1	1	
Egretta alba				1			1					
Egretta ardesiaca	1		1	1	1	1	1	1		1	1	1
Egretta garzetta	1		1	1	1	1	1	1	1	1	1	1
Egretta gularis							1					
Egretta intermedia							1					
Eichhornia crassipes					1		1		1		1	1
Eidolon helvum							1					
Elanus caeruleus							1		1			
Elapsoidea loveridgei multicincta							1					
Elapsoidea sundevallii laticincta	1											
Elasmodactylus tuberculosus							1					
Elattoneura centrafricana										1		
Elattoneura glauca					1	1	1	1		1	1	
Elattoneura nigra	1					1				1		1
Elattoneura vittata										1		
Electris nanus												1
Eleocharis quinqueflora									1			
Elephantulus brachyrhynchus							1					
Elephantulus rufescens							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Elephantulus rufescens	1											
Elminia albicauda							1					
Elminia longicauda							1					
Elminia nigromitrata				1	1		1			1	1	
Emberiza cabanisi							1					
Emberiza caesia									1			
Emberiza flaviventris							1					
Emberiza tahapisi							1					
Eminia lepida				1	1		1	1		1	1	
Enteromius anema			1									1
Enteromius apleurogramma				1	1		1	1		1	1	
Enteromius cercops				1	1		1	1		1	1	
Enteromius jacksoni				1	1		1	1		1	1	
Enteromius kerstenii				1	1		1	1		1	1	
Enteromius leonensis			1									
Enteromius loveridgii							1				1	
Enteromius magdalenae				1	1		1	1			1	
Enteromius miolepis										1		
Enteromius neglectus			1						1			
Enteromius neumayeri				1	1		1	1		1	1	
Enteromius nigeriensis	1											1
Enteromius nyanzae				1			1	1			1	
Enteromius paludinosus				1	1	1	1	1			1	
Enteromius pellegrini										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Enteromius perince	1		1	1					1	1		1
Enteromius pleurogramma				1		1						
Enteromius profundus							1	1			1	
Enteromius pumilus	1		1									1
Enteromius quadralineatus							1					
Enteromius radiatus				1	1		1	1			1	
Enteromius sexradiatus											1	
Enteromius stigmatopygus	1		1	1					1			1
Enteromius tanapelagius						1						
Enteromius tongaensis												1
Enteromius trinotatus										1		
Enteromius trispilopleura						1						
Enteromius viktorianus							1				1	
Enteromius yeiensis												1
Enteromius yongei					1		1				1	
Enydra fluctuans	1		1	1	1	1	1	1		1	1	1
Eodrepanus fastiditus							1					
Eodrepanus parallelus							1					
Ephippiorhynchus senegalensis	1		1	1	1	1	1	1	1	1	1	1
Epiplatys bifasciatus	1											1
Epiplatys marnoi												1
Epiplatys spilargyreius	1		1	1								1
Epomophorus anurus	1											
Epomophorus labiatus							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Epomophorus minor							1					
Epomophorus wahlbergi							1					
Epomops franqueti							1					
Equus bruchelli				1								1
Equus quagga							1					
Eremalauda dunni				1								
Eremomela canescens	1		1	1		1	1	1			1	1	1
Eremomela icteropygialis				1	1	1		1	1			1	
Eremomela scotops								1					
Eremopterix leucopareia								1					
Eremopterix leucotis									1				
Eremopterix nigriceps									1				
Eriocaulon							1						
Erythrocebus patas	1		1	1		1		1					1
Erythrocebus poliophaeus							1						
Estrida astrid								1					
Estrilda astrild	1		1		1	1	1	1	1		1	1	1
Estrilda erythronotos								1					
Estrilda melpoda										1			
Estrilda nonnula								1					
Estrilda paludicola								1					
Estrilda rhodopyga								1	1				
Estrilda troglodytes				1				1					1
Estrildar hodopyga				1									

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Etheria elliptica			1	1		1	1	1	1	1	1	1
Ethulia conyzoides	1		1	1	1	1	1	1	1	1	1	1
Ethulia scheffleri						1		1			1	
Ethulia vernonioides								1			1	
Eucalyptus								1				
Euchilichthys royauxi										1		
Eudorcas albonotata	1		1				1					1
Eudorcas rufifrons			1	1								
Eudorcas thomsonii								1				
Eulioptera reticulata								1				
Eulioptera spinulosa								1				
Eulophia angolensis					1							
Euodice cantans									1			
Euoniticellus kawanus								1				
Euoniticellus nasicornis								1				
Eupera crassa								1			1	
Eupera ferruginea	1		1	1			1	1		1		1
Eupera ovata										1		
Eupera sturanyi	1									1		1
Euplectes afer	1			1		1	1	1		1	1	1
Euplectes albonotatus					1	1		1	1	1	1	
Euplectes ardens					1	1		1		1		
Euplectes axillaris	1		1	1	1	1	1	1	1	1	1	1
Euplectes capensis								1				

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Euplectes franciscanus									1	1		
Euplectes gierowii			1		1		1			1	1	
Euplectes hartlaubi						1				1		
Euplectes hordeaceus							1					
Euplectes laticauda			1				1				1	
Euplectes macroura	1		1		1	1	1	1		1	1	1
Euplectes orix							1					
Eupodotis senegalensis				1			1					
Eurillas curvirostris							1					
Eurillas gracilis							1					
Eurillas latirostris							1					
Eurillas virens							1					
Eurocephalus ruppelli							1					
Eurystomus glaucurus	1		1	1	1	1	1	1		1	1	1
Eurystomus gularis							1					
Euxerus erythropus lacustris	1											
Falco alopex												1
Falco amurensis					1	1		1			1	
Falco ardosiaceus							1					
Falco biamicus				1								
Falco biarmicus							1					
Falco cherrug	1		1	1			1	1	1		1	1
Falco cuvierii							1					
Falco naumanni	1			1	1	1	1	1	1	1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Falco pelegrinoides				1								
Falco peregrinus			1	1	1	1	1	1	1	1	1	
Falco ruficollis							1					
Falco subbuteo	1		1	1	1	1	1	1	1	1	1	1
Falco tinnunculus				1			1		1			
Falco vespertinus	1		1	1	1	1	1	1	1	1	1	1
Felis chaus									1			
Felis lybica	1											
Felis silvestris							1					
Ferrissia kavirondica							1				1	
Ferrissia pallaryi									1			
Ferrissia toroensis										1		
Feylinia currori							1					
Ficedula semitorquata							1		1			
Filinia												1
Floscopa glomerata						1						
Francolinus clapper Toni				1								
Fraseria caerulescens							1					
Fraseria griseigularis							1					
Fraseria plumbea							1					
Fringillaria striolata									1			
Fuirena ciliaris									1			
Fuirena pubescens									1			
Fulica atra				1					1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Fulica cristata				1	1	1	1	1		1	1	
Funisciurus multicolor	1											
Funisciurus pyrropus							1					
Gabbiella barthi											1	
Gabbiella humerosa					1		1	1		1	1	
Gabbiella kichwambae										1		
Gabbiella parva										1		
Gabbiella senaariensis	1		1	1		1			1			1
Galago matschiei							1					
Galago moholi							1					
Galago senegalensis							1					
Galagoides demidoff							1					
Galagoides thomasi							1					
Galerella ochracea	1											
Galerida cristata									1			
Galerida modesta												1
Gallinago gallinago	1		1	1	1	1	1	1	1	1	1	1
Gallinago media	1		1	1	1	1	1	1	1	1	1	1
Gallinago nigripennis					1	1	1	1		1	1	
Gallinula angulata	1		1	1	1		1	1		1	1	1
Gallinula chloropus				1	1	1	1	1	1	1	1	
Gallirex porphyreolophus							1					
Gambusia affinis							1					
Garra dembecha				1		1						

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Garra dembeensis	1		1	1	1	1	1	1	1	1	1	1
Garra regressus						1						
Garra tana						1						
Garreta azureus							1					
Garreta malleolus							1					
Garreta nitens							1					
Gazza minuta									1			
Gelochelidon nilotica	1			1	1	1		1	1	1	1	1
Genetta						1						
Genetta angolensis							1					
Genetta genetta							1					
Genetta maculata							1					
Genetta servalina							1					
Genetta tigrina	1											
Geochelone pardalis							1					
Geokichla crossleyi										1		
Gerbilliscus boehmi							1					
Gerbilliscus kempi							1					
Gerbilliscus robustus	1						1					
Gerbilliscus validus							1					
Gerbillus harwoodi							1					
Gerbillus pusillus							1					
Geronticus eremita						1						
Giraffa camelopardalis							1					1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Giraffa camelopardalis camelopardalis			1	1								
Glareola nordmanni	1		1	1		1			1	1		1
Glareola nuchalis				1		1	1	1		1	1		
Glareola ocularis								1	1			1	
Glareola pratincola	1		1	1	1	1	1	1	1	1		1	1
Glaucidium perlatum								1					
Glaucidium tephronotum								1					
Glauconycteris argentata								1					
Glauconycteris humeralis								1					
Glauconycteris poensis								1					
Glauconycteris variegata								1					
Glinus lotoides													1
Gnaphalium crispatulum									1				
Gnathonemus longibarbis					1	1		1	1			1	
Gnathonemus victoriae								1					
Gnathonemuslongibarbis					1								
Gnethonemus longibarbis												1	
Gomphidia bredoi						1		1	1		1	1	
Gomphidia quarrei					1	1		1	1		1	1	
Grammomys dolichurus								1					
Grammomys dryas								1					
Grammomys kuru								1					
Grammomys macmillani	1												1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Granatina ianthinogaster							1					
Grangea maderaspatana	1		1	1	1	1	1	1	1	1	1	1
Graphiurus	1											
Graphiurus microtis							1					
Graphiurus murinus							1			1	1	
Grayia smythii	1											
Grayia tholloni							1					
Grus grus	1		1	1		1			1			1
Guttera verreauxi							1					
Gymnarchus niloticus			1	1		1						1
Gymnobucco cinereiceps							1					
Gymnoris dentata												1
Gymnoris pyrgita							1		1			
Gymnoris superciliaris							1					
Gynacantha africana					1	1	1			1		
Gynacantha bullata					1	1	1	1		1	1	
Gynacantha cylindrata					1	1	1	1		1		
Gynacantha manderica					1	1	1	1		1	1	
Gynacantha nigeriensis	1		1		1	1	1			1		1
Gynacantha sextans										1		
Gynacantha vesiculata					1	1	1			1		
Gynacantha victoriae							1					
Gynacantha villosa			1		1	1	1	1		1	1	
Gypohierax angolensis							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Gyps africanus				1			1	1	1		1	
Gyps fulvus									1			
Gyps rueppelli							1		1			
Gyps rueppillii											1	
Gyraulus costulatus	1		1	1	1	1	1	1	1	1	1	1
Hadrothemis camarensis							1					
Hadrothemis coacta					1	1	1			1		
Hadrothemis defecta					1	1	1			1		
Hadrothemis infesta					1	1	1			1		
Hadrothemis versuta					1	1	1			1		
Haematopus ostralegus									1			
Hagedash hagedash				1								
Halcyon chelicuti							1			1		
Halcyon leucocephala	1		1	1	1	1	1	1	1	1	1	1
Halcyon malimbica					1	1	1			1		
Halcyon senegalensis	1		1	1	1	1	1	1		1	1	1
Halcyon smyrnensis									1			
Haliaeetus vocifer	1		1	1	1	1	1	1	1	1	1	1
Haplochromine cichlids											1	
Haplochromine multicolour											1	
Haplochromines						1		1				
Haplochromis acidens							1	1			1	
Haplochromis aelocephalus							1	1			1	
Haplochromis aeneocolor										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Haplochromis altigenis							1	1			1	
Haplochromis angustifrons										1		
Haplochromis apogonoides							1	1			1	
Haplochromis arcanus							1	1			1	
Haplochromis argenteus							1	1			1	
Haplochromis artaxerxes							1	1			1	
Haplochromis azureus							1	1			1	
Haplochromis barbarae							1	1			1	
Haplochromis bareli							1	1			1	
Haplochromis bartoni							1	1			1	
Haplochromis bayoni							1	1			1	
Haplochromis bicolor							1	1			1	
Haplochromis boops							1	1			1	
Haplochromis brownae							1	1			1	
Haplochromis bwathondii							1	1			1	
Haplochromis cassius							1	1			1	
Haplochromis cavifrons							1	1			1	
Haplochromis chilotes							1	1			1	
Haplochromis chlorochrous							1	1			1	
Haplochromis chromogynos							1	1			1	
Haplochromis chrysogynaion							1	1			1	
Haplochromis cinctus							1	1			1	
Haplochromis cinereus							1	1			1	
Haplochromis cnester							1	1			1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Haplochromis crassilabris							1	1			1	
Haplochromis crocopeplus							1	1			1	
Haplochromis cronus							1	1			1	
Haplochromis cryptodon							1	1			1	
Haplochromis cryptogramma							1	1			1	
Haplochromis decticostoma							1	1			1	
Haplochromis degeni							1	1			1	
Haplochromis dentex							1	1			1	
Haplochromis dichrourus							1	1			1	
Haplochromis diplotaenia							1	1			1	
Haplochromis dolichorhynchus							1	1			1	
Haplochromis eduardianus										1		
Haplochromis elegans										1		
Haplochromis empodisma							1	1			1	
Haplochromis erythrocephalus							1	1			1	
Haplochromis estor							1	1			1	
Haplochromis eutaenia							1	1			1	
Haplochromis fischeri							1	1			1	
Haplochromis flavipinnis							1	1			1	
Haplochromis flavus							1	1			1	
Haplochromis fusiformis							1	1			1	
Haplochromis gigas							1	1			1	
Haplochromis gilberti							1	1			1	
Haplochromis goldschmidti							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Haplochromis gowersii							1	1			1	
Haplochromis granti							1	1			1	
Haplochromis greenwoodi							1	1			1	
Haplochromis guiarti							1	1			1	
Haplochromis harpakteridion							1	1			1	
Haplochromis heusinkveldi							1	1			1	
Haplochromis hiatus							1	1			1	
Haplochromis howesi							1	1			1	
Haplochromis humilior							1	1			1	
Haplochromis igneopinnis							1	1			1	
Haplochromis iris							1	1			1	
Haplochromis ishmaeli							1	1			1	
Haplochromis kujunjui							1	1			1	
Haplochromis labiatus										1		
Haplochromis labriformis							1	1			1	
Haplochromis lacrimosus							1	1			1	
Haplochromis laparogramma							1	1			1	
Haplochromis limax										1		
Haplochromis lividus							1	1			1	
Haplochromis loati										1		
Haplochromis longirostris							1	1			1	
Haplochromis luteus							1	1			1	
Haplochromis macrocephalus							1	1			1	
Haplochromis macrognathus							1	1			1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Haplochromis macrops							1	1			1	
Haplochromis macropsoides										1		
Haplochromis maculipinna							1	1			1	
Haplochromis maisomei							1	1			1	
Haplochromis mandibularis							1	1			1	
Haplochromis martini							1	1			1	
Haplochromis maxillaris							1	1			1	
Haplochromis mbipi							1	1			1	
Haplochromis megalops							1	1			1	
Haplochromis melanopterus							1	1			1	
Haplochromis melanopus							1	1			1	
Haplochromis melichrous							1	1			1	
Haplochromis mento							1	1			1	
Haplochromis michaeli							1	1			1	
Haplochromis microdon							1	1			1	
Haplochromis mylergates							1	1			1	
Haplochromis mylodon										1		
Haplochromis nanoserranus							1	1			1	
Haplochromis nigrescens							1	1			1	
Haplochromis nigricans							1	1			1	
Haplochromis nigripinnis										1		
Haplochromis niloticus							1	1			1	
Haplochromis nubilus							1	1			1	
Haplochromis nuchisquamulatus							1	1			1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Haplochromis nyanzae							1	1			1	
Haplochromis nyererei							1	1			1	
Haplochromis obesus							1	1			1	
Haplochromis obliquidens							1	1			1	
Haplochromis obtusidens							1	1			1	
Haplochromis oligolepis							1					
Haplochromis omnicaeruleus							1	1			1	
Haplochromis oregosoma										1		
Haplochromis pachycephalus							1	1			1	
Haplochromis pallidus							1	1			1	
Haplochromis pappenheimi										1		
Haplochromis paradoxus										1		
Haplochromis paraguiarti							1	1			1	
Haplochromis paraplagiostoma							1	1			1	
Haplochromis paropius							1	1			1	
Haplochromis parorthostoma							1	1			1	
Haplochromis parvidens							1	1			1	
Haplochromis pellegrini							1	1			1	
Haplochromis percoides							1	1			1	
Haplochromis perrieri							1	1			1	
Haplochromis petronius										1		
Haplochromis pharyngomylus							1	1			1	
Haplochromis phytophagus							1	1			1	
Haplochromis piceatus							1	1			1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Haplochromis pitmani							1	1			1	
Haplochromis plagiodon							1	1			1	
Haplochromis plagiostoma							1	1			1	
Haplochromis plutonius							1	1			1	
Haplochromis prodromus							1	1			1	
Haplochromis prognathus							1	1			1	
Haplochromis pseudopellegrini							1	1			1	
Haplochromis ptistes							1	1			1	
Haplochromis pundamilia							1	1			1	
Haplochromis pyrrhocephalus							1	1			1	
Haplochromis pyrrhopteryx							1	1			1	
Haplochromis retrodens							1	1			1	
Haplochromis riponianus							1	1			1	
Haplochromis rubripinnis							1	1			1	
Haplochromis rufocaudalis							1	1			1	
Haplochromis rufus							1	1			1	
Haplochromis sauvagei							1	1			1	
Haplochromis saxicola							1	1			1	
Haplochromis schubotzi										1		
Haplochromis schubotziellus										1		
Haplochromis serranus							1	1			1	
Haplochromis simotes							1	1			1	
Haplochromis sp. nov. 'Blue Rockpicker'							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Haplochromis spekii							1	1			1	
Haplochromis squamipinnis										1		
Haplochromis squamulatus							1	1			1	
Haplochromis sulphureus							1	1			1	
Haplochromis tanaos							1	1			1	
Haplochromis taurinus										1		
Haplochromis teegelaari							1	1			1	
Haplochromis teunisrasi							1	1			1	
Haplochromis theliodon							1	1			1	
Haplochromis thereuterion							1	1			1	
Haplochromis thuragnathus							1	1			1	
Haplochromis tridens							1	1			1	
Haplochromis tyrianthinus							1	1			1	
Haplochromis ushindi							1	1			1	
Haplochromis vanoijeni							1	1			1	
Haplochromis victoriae							1	1			1	
Haplochromis victorianus							1	1			1	
Haplochromis vonlinnei							1	1			1	
Haplochromis welcommei							1	1			1	
Haplochromis worthingtoni						1						
Haplochromis xanthopteryx							1	1			1	
Haplochromis xenognathus							1	1			1	
Haplochromis xenostoma							1	1			1	
Hedydipna collaris				1		1	1	1		1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Hedydipna metallica									1			
Heliaeschna cynthiae				1	1		1			1		
Heliaeschna fuliginosa					1		1			1		
Heliaeschna trinervulata				1			1			1		
Heliaeschna ugandica					1		1			1		
Helichrysum formosissimum	1		1	1	1	1	1	1		1	1	1
Heliophobius argenteocinereus							1					
Heliosciurus rufobrachium							1					
Helioscurus multicolor	1											
Helogale hirtula	1											
Helogale parvula							1					
Hemarthria altissima									1			
Hemichromis bimaculatus									1			
Hemichromis elongatus										1		
Hemichromis fasciatus			1	1								
Hemichromis letourneuxi				1		1			1			
Hemicordulia africana				1	1		1	1		1	1	
Hemicordulia asiatica					1							
Hemidactylus mabouia							1					
Hemirhagerrhis hildebrandtii							1					
Hemistigma albipunctum	1		1		1	1	1	1		1	1	1
Hemisus guineensis				1	1		1	1		1	1	
Hemisus marmoratus	1		1	1	1	1	1	1		1	1	1
Hemisus olivaceus										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Hemitesia neumanni										1		
Heremites vittatus									1			
Heron ardeola idea							1					
Herpestes ichneumon	1		1	1	1	1	1	1	1	1	1	1
Herpestes naso										1		
Herpestes sanguineus							1					
Heteranthera callifolia	1		1	1	1	1	1	1		1	1	1
Heterobranchus bidorsalis			1	1								
Heterobranchus longifilis			1	1		1		1	1	1	1	1
Heterohyrax brucei							1					
Heteronitis castelnaui							1					
Heterotis niloticus			1	1								1
Hieraaetus ayresii							1					
Hieraaetus pennatus				1			1		1			
Hieraaetus wahlbergi							1		1			
Hildebrandtia ornata	1					1		1		1	1	1
Himantopus himantopus	1		1	1	1	1	1	1	1	1	1	1
Himantornis haematopus										1		
Hippolais icterina					1			1	1			
Hippolais languida							1					
Hippolais olivetorum							1		1			
Hippopotamus amphibius	1		1	1	1	1	1	1		1	1	1
Hippopotamyrus grahami					1	1		1			1	
Hippopotamyrus harringtoni				1			1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Hippopotamyrus pictus			1	1								
Hipposideros beatus										1		
Hipposideros caffer	1			1		1				1	1	1
Hipposideros cyclops							1					
Hipposideros ruber							1					
Hippotragus equinus	1		1	1			1					1
Hippotragus niger							1					
Hirundo aethiopica	1		1	1		1	1	1	1	1		1
Hirundo angolensis					1	1	1	1		1	1	
Hirundo atrocaerulea						1	1			1	1	
Hirundo lucida			1				1					
Hirundo nigrita										1		
Hirundo rustica	1		1		1	1	1	1	1	1	1	1
Hirundo rustica savignii									1			
Hirundo smithii	1		1	1	1	1	1	1	1	1	1	1
Histurgops ruficauda							1					
Hoplobatrachus occipitalis	1		1	1	1	1	1	1		1	1	1
Hyaena hyaena			1	1	1	1	1	1	1		1	1
Hybomys univittatus							1					
Hydrictis maculicollis	1		1		1	1	1	1		1	1	1
Hydrilla verticillata	1				1	1	1	1		1	1	1
Hydrocharis chevalieri										1		
Hydrocoloeus minutus									1			
Hydrocotyle ranunculoides							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Hydrocynus												1
Hydrocynus brevis	1		1	1								1
Hydrocynus forskahlii	1		1	1		1	1		1	1		1
Hydrocynus forskalii										1		1
Hydrocynus vittatus			1	1	1		1			1		
Hydrophylax galamensis							1					
Hydroprogne caspia	1		1	1	1	1	1	1	1	1	1	1
Hygrophila asteracanthoides			1			1						
Hygrophila auriculata						1						
Hygrophila schulli			1									
Hygrophila senegalensis										1		
Hygrophila spiciformis							1					
Hylia prasina							1					
Hyliota flavigaster							1					
Hylomyscus stella							1					
Hylopsar purpureiceps							1					
Hymenochirus boettgeri										1		
Hyparrhenia										1		
Hyparrhenia filapendula				1								
Hyparrhenia filipendula				1								
Hyparrhenia rufa												1
Hyparrhenia ruffa												1
Hyperolius acuticeps							1					
Hyperolius balfouri	1		1			1	1			1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Hyperolius castaneus										1		
Hyperolius chrysogaster										1		
Hyperolius cinnamomeoventris					1		1			1	1	
Hyperolius discodactylus										1		
Hyperolius frontalis										1		
Hyperolius glandicolor				1			1	1			1	
Hyperolius kivuensis			1	1	1		1	1		1	1	1
Hyperolius kivuensis bituberculatus							1					
Hyperolius kivuensis kivuensis							1					
Hyperolius kuligae					1		1			1		
Hyperolius langi										1		
Hyperolius lateralis				1	1		1			1		
Hyperolius montanus											1	
Hyperolius ocellatus										1		
Hyperolius papyri												1
Hyperolius rwandae				1								
Hyperolius tuberculatus										1		
Hyperolius viridi											1	
Hyperolius viridiflavus	1		1		1	1	1	1	1	1	1	1
Hyperolius viridiflavus bayoni							1					
Hyperolius viridiflavus variabilis							1					
Hyperolius viridiflavus viridiflavus							1					
Hyperopisus bebe			1	1		1			1	1		
Hypoestes aristata							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Hypsipetes leucocephalus				1								
Hypsopanchax modestus										1		
Hypsopanchax platysternus										1		
Hystrix africaeaustralis							1					
Hystrix cristata						1	1					
Ichneumia albicauda	1		1	1	1	1	1	1		1	1	1
Ichthyborus besse			1									
Ictinogomphus ferox	1		1		1	1	1	1		1	1	1
Ictinogomphus regisalberti										1		
Ictonyx striatus	1						1					
Idomacromia jillianae										1		
Iduna natalensis					1	1	1	1		1	1	1
Iduna pallida							1		1			
Iduna similis										1	1	
Illadopsis albipectus							1					
Illadopsis fulvescens							1					
Illadopsis rufipennis							1					
Indicator exilis							1					
Indicator indicator							1					
Indicator meliphilus							1					
Indicator minor							1		1			
Indicator variegatus							1					
Inversodicraea cristata	1											1
Ipomoea acquatica											1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Ipomoea aquatica							1					
Ipomoea cairica							1					
Ipomoea rubens							1					
Ipomoea stolonifera											1	
Ipomoea wrightil											1	
Ischnura senegalensis	1		1	1	1	1	1	1	1	1	1	1
Isoetes alstonii					1	1		1	1		1	
Isoetes welwitschii	1		1	1			1					1
Ispidina lecontei						1		1		1		
Ispidina picta	1		1	1	1	1	1	1	1		1	1
Ixobrychus minutus	1		1	1	1	1	1	1	1	1	1	1
Ixobrychus sturmii	1		1		1	1		1	1		1	1
Ixonotus guttatus								1				
Juncus acutus									1			
Juncus bufonius			1	1	1	1	1	1	1	1	1	
Juncus dregeanus	1		1	1	1	1	1	1	1		1	1
Juncus dregeanus subsp. bachitii			1								1	
Juncus effusus	1		1	1	1	1	1	1	1		1	1
Juncus fontanesii									1			
Juncus hybridus									1			
Juncus inflexus	1								1	1		1
Juncus maritimus									1			
Juncus oxycarpus			1		1		1	1	1		1	1
Juncus punctorius	1		1	1			1					1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Juncus rigidus	1		1	1		1			1	1		1
Juncus subulatus									1			
Justicia bolomboensis										1		
Jynx ruficollis							1					
Jynx torquilla							1					
Kassina senegalensis	1		1	1	1	1	1	1		1	1	1
Kaupifalco monogramicus				1								
Kaupifalco monogrammicus							1					
Keratella												1
Kerivoula argentata							1					
Kerivoula lanosa							1					
Kinixys belliana							1					
Kobus defassus	1											
Kobus ellipsiprymnus	1		1	1	1		1			1		1
Kobus ellipsiprymnus ssp. defassa							1					
Kobus ellipsiprymnus defassa	1											
Kobus kob	1		1			1				1		1
Kobus kob ssp. leucotis			1									
Kobus megaceros	1		1									1
Kribia nana			1	1								1
Kuhlia mugil									1			
Labeo				1								
Labeo bottegi			1									
Labeo coubie	1		1	1		1				1		1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Labeo cylindricus			1	1		1	1				1	
Labeo forskalii	1		1	1						1		1
Labeo niloticus	1			1					1			1
Labeo parvus							1					
Labeo tongaensis												1
Labeo victorianus				1	1		1	1		1		
Labeo werneri							1					
Labeobarbus acuticeps				1								
Labeobarbus acutirostris						1						
Labeobarbus altianalis				1	1		1	1		1	1	
Labeobarbus barbs						1						
Labeobarbus bynni			1	1					1	1		1
Labeobarbus caudovittatus										1		
Labeobarbus claudinae				1								
Labeobarbus crassibarbis						1						
Labeobarbus dainellii						1						
Labeobarbus gorgorensis						1						
Labeobarbus gorguari						1						
Labeobarbus huloti										1		
Labeobarbus longissimus						1						
Labeobarbus macrolepis							1					
Labeobarbus macrophtalmus						1						
Labeobarbus mawambiensis										1		
Labeobarbus megastoma						1						

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Labeobarbus nedgia			1	1		1						
Labeobarbus ossensis						1						
Labeobarbus platydorsus						1						
Labeobarbus somereni				1			1			1		
Labeobarbus surkis						1						
Labeobarbus truttiformis						1						
Labeobarbus tsanensis						1						
Laciris pelagica										1		
Laephotis wintoni							1					
Lagarosiphon cordofanus			1	1	1	1	1	1		1	1	1
Lagarosiphon hydrilloides					1		1				1	
Lagarosiphon ilicifolius				1	1		1	1		1	1	
Lagonostica senegala				1								
Lagonosticta rara												1
Lagonosticta rhodopareia							1					
Lagonosticta rubricata			1		1	1	1			1	1	
Lagonosticta rufopicta							1					
Lagonosticta senegala							1		1	1		
Lake Victorianus							1					
Lamprophis fuliginosus							1					
Lamprotornis caudatus				1								
Lamprotornis chalcurus												1
Lamprotornis chalybaeus				1			1					
Lamprotornis chloropterus							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Lamprotornis hildebrandti							1					
Lamprotornis pulcher									1			
Lamprotornis purpureus							1					1
Lamprotornis purpuroptera							1			1		
Lamprotornis purpurpopterus				1								
Lamprotornis splendidus							1					
Lamprotornis superbus							1					
Lamprotornis unicolor							1					
Landoltia punctata									1			
Laniarius aethiopicus							1					
Laniarius erthrogaster							1					
Laniarius erythrogaster	1		1	1	1	1	1	1	1	1	1	1
Laniarius funebris							1					
Laniarius leucorhynchus						1	1			1		
Laniarius luehderi							1					
Laniarius mufumbiri				1	1	1	1			1	1	
Lanistes ovum	1		1	1	1	1	1	1		1	1	1
Lanius cabanisi							1					
Lanius collaris					1	1	1	1		1	1	
Lanius collurio	1		1	1	1	1	1	1	1	1	1	1
Lanius excubitor				1			1		1			
Lanius excubitoroides							1					
Lanius gubernator												1
Lanius isabellinus	1		1	1	1	1	1	1	1	1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Lanius mackinnoni							1					
Lanius minor				1						1		
Lanius nubicus									1			
Lanius phoenicuroides	1		1	1	1	1	1	1	1	1	1	1
Lanius senator							1		1			
Lanius souzae							1					
Larus argentatus							1					
Larus armenicus									1			
Larus cachinnans									1			
Larus canus									1			
Larus cirrocephalus	1		1	1	1	1	1	1		1	1	1
Larus cirrocepharus							1					
Larus fuscus			1		1	1	1	1	1	1	1	
Larus genei									1			
Larus ichthyaetus									1			
Larus melanocephalus									1			
Larus michahellis									1			
Larus minutus									1			
Larus ridibundus				1	1	1		1	1	1	1	
Lates albertianus							1					
Lates macrophthalmus										1		
Lates microphthalmus										1		
Lates niloticus			1	1		1	1	1	1	1		1
Latodrepanus laticollis							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Laudetia phragmitoides											1	
Laurus nobilis									1			
Lavia frons							1					
Lavia frons affinis	1											
Lecane												1
Leersia hexandra					1						1	
Lemna gibba			1	1		1	1	1	1	1		1
Lemna minor			1	1	1	1	1	1	1	1	1	1
Lemna paucicosta										1		
Lemna perpusilla	1		1	1	1	1	1	1		1	1	1
Lemna trisulca			1	1		1	1	1			1	
Lemnia sp							1					
Lemniscomys macculus							1					
Lemniscomys rosalia							1					
Lemniscomys striatus							1					
Lemniscomys zebra							1					
Lentorbis junodi				1	1	1		1	1		1	1
Leptailurus serval	1		1	1	1	1	1	1	1	1	1	1
Leptocypris niloticus			1						1			1
Leptoglanis sp							1					
Leptopelis bocagii			1		1		1	1				
Leptopelis calcaratus										1		
Leptopelis christyi					1		1			1		
Leptopelis kivuensis										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Leptopelis oryi										1		
Leptopelis viridis	1											
Leptoptilos crumenifer	1		1	1	1	1	1	1	1	1	1	1
Leptosiaphos aloysiisabaudiae						1				1		1
Leptotyphlops cairi	1											
Leptotyphlops emini emini	1											
Leptotyphlops macrops							1					
Lepus	1											
Lepus capensis							1					
Lepus victoriae							1					
Lestes dissimulans					1	1	1	1		1	1	
Lestes ictericus	1		1	1	1	1	1	1		1	1	1
Lestes pallidus	1		1	1	1	1	1	1	1	1	1	1
Lestes plagiatus					1	1	1	1		1	1	
Lestes tridens	1		1		1	1	1	1		1	1	1
Lestes uncifer					1	1	1	1		1	1	
Lestes virgatus			1		1	1	1	1		1	1	
Lestinogomphus angustus					1	1	1	1		1	1	
Lestinogomphus congoensis										1		
Liatongus arrowi							1					
Limnocaridella alberti										1		
Limnophila rugosa	1				1		1	1			1	
Limnophs bicolour										1		
Limnophyton obtusifolium	1		1	1	1	1	1	1	1	1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Limnotragus spekei	1											
Limosa lapponica									1			
Limosa limosa	1		1	1	1	1	1	1	1	1	1	1
Lipochromis maxillaris							1					
Lissonycteris angolensis							1					
Lissotis melanogaster	1		1		1	1	1	1	1	1	1	1
Litogyne gariepina				1		1		1	1		1	
Locustella fluviatilis	1		1	1	1	1	1	1	1	1	1	1
Locustella luscinioides	1			1			1		1			1
Locustella naevia							1					
Lonchura cantans				1								
Lonchura fringilloides							1					
Lophaetus occipitalis	1		1	1	1	1	1	1		1	1	1
Lophocebus albigena							1					
Lophoceros alboterminatus							1					
Lophoceros camurus										1		
Lophoceros fasciatus							1					
Lophoceros hemprichii						1						
Lophoceros nasutus							1					
Lophuromys sikapusi							1					
Loudetia										1		
Loxodonta africana	1		1	1	1	1		1		1	1	1
Luffa cylindrica							1					
Luffa cylindrical												1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Luscinia megarhynchos							1					
Luscinia svecica									1			
Lutra lutra									1			
Lutra maculicollis										1	1	
Lutra maculicollis nilotica	1											
Luzula abyssinica				1		1	1	1		1	1	
Luzula johnstonii			1			1	1	1		1	1	
Luzula mannii					1		1				1	
Lybius bidentatus										1		
Lybius guifsobalito							1			1		
Lybius leucocephalus	1			1	1		1	1		1	1	1
Lybius rubrifacies							1					
Lybius torquatus				1			1					
Lybius undatus						1						
Lycaon pictus	1			1								1
Lycophidion capense capense	1											
Lycophidion ornatum							1					
Lygosoma sundevalli							1					
Lygosoma sundevalli afrum							1					
Lymnocryptes minimus	1		1	1		1	1	1	1	1	1	1
Lyngbya limnetica												1
Lythrum junceum									1			
Macheiramphus alcinus			1		1	1		1		1	1	
Macrobrachium chevalieri										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Macrobrachium dux										1		
Macrobrachium idella				1			1	1				
Macrobrachium lepidactylus				1			1	1			1	
Macrobrachium lujae	1									1		1
Macrobrachium macrobrachion										1		
Macrobrachium niloticum	1		1	1	1	1	1	1	1	1	1	1
Macrobrachium rude				1			1	1			1	
Macrobrachium scabriculum				1			1	1			1	
Macrobrachium sollaudii										1		
Macrobrachium vollenhoveni										1		
Macronyx ameliae							1					
Macronyx croceus							1			1		
Macroprotodon cucullatus									1			
Macrosphenus concolor							1					
Macrosphenus flavicans							1					
Madoqua kirkii							1					
Malacochersus tornieri							1					
Malacomys longipes							1			1		
Malaconotus blanchoti							1					
Malapterurus electricus			1	1		1	1		1	1		
Malgassophlebia bispina				1		1	1	1		1	1	
Malimbus malimbicus							1					
Malimbus rubricollis							1					
Mandingoa nitidula							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Marcusenias grahami											1	
Marcusenius cyprinoides			1	1		1			1			1
Marcusenius rheni							1	1			1	
Marcusenius victoriae				1	1		1	1			1	
Mareca penelope	1		1	1	1	1	1	1	1	1	1	1
Mareca strepera			1	1		1			1			1
Marmaronetta angustirostris									1			
Marsilea aegyptiaca	1		1	1		1			1			1
Marsilea coromandelina				1			1	1			1	
Marsilea minuta	1		1	1	1	1	1	1	1	1	1	1
Mastacembells fretanus											1	
Mastacembelus congicus										1		
Mastacembelus frenatus				1	1		1	1		1	1	
Mastomys alghazal	1											
Mastomys blainei	1											
Mastomys butleri	1											
Mastomys erythroleucus							1					
Mastomys kollmannspergeri				1								
Mastomys natalensis							1					
Mastomys pernanus							1					
Megabyas flammulatus							1					
Megaceryle maxima	1		1	1	1	1	1	1		1	1	1
Megaloglossus woermanni							1					
Meizodon coronatus	1											

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Meizodon semiornatus							1					
Melaenornis edolioides							1			1		
Melaenornis pammelaina							1					
Melaenornis semipartitus							1					
Melaniparus albiventris							1					
Melaniparus fringillinus							1					
Melaniparus funereus							1					
Melaniparus guineensis							1					
Melaniparus leucomelas							1					
Melaniparus pallidiventris							1					
Melanocorypha bimaculata									1			
Melanoides tuberculata	1		1	1	1	1	1	1	1	1	1	1
Melierax metabates									1			
Mellivora capensis							1					
Mellivora capensis	1											
Melocichla mentalis							1					
Mercusenius grahami							1					
Mercusenius macrolepidotus							1					
Meriones libycus									1			
Merop snubicoides				1								
Merops albicollis	1		1	1	1	1	1	1	1	1	1	1
Merops apiaster					1				1	1		
Merops breweri										1		
Merops bullockoides											1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Merops bulocki	1		1	1	1	1				1		1
Merops gularis										1		
Merops hirundineus							1					
Merops muelleri							1					
Merops nubicus	1		1	1		1			1	1		1
Merops orientalis									1			
Merops persicus	1		1	1	1	1	1	1	1	1	1	1
Merops pusillus	1		1	1	1	1	1	1	1	1	1	1
Merops pussilus				1								
Merops superciliosus					1	1		1	1	1	1	
Merops variegatus					1	1		1		1	1	
Merops viridissimus	1		1	1					1			1
Merpos bulocki				1								
Mertensophryne taitana							1					
Mesobola spinifer							1					
Mesocnemis robusta	1			1					1			1
Mesocnemis singularis	1				1	1		1	1	1	1	1
Micralestes acutidens	1		1									1
Micralestes stormsi										1		
Microcarbo africanus	1		1	1	1	1	1	1	1	1	1	1
Microctenopoma damasi						1				1		
Microgomphus schoutedeni						1		1		1		
Micromacromia camerunica	1				1	1		1		1	1	1
Micronisus gabar	1		1	1	1	1	1	1		1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Micropanchax hutereaui	1			1						1		
Micropanchax kingii	1			1								
Micropanchax loati	1			1	1	1		1	1	1	1	1
Microparra capensis	1		1	1		1		1		1	1	1
Microphis fluviatilis					1	1		1	1		1	
Micropotamogale ruwenzorii										1		
Micropteropus pusillus							1					
Milvis migrans						1						
Milvus migrans	1		1	1	1	1	1	1	1	1	1	1
Milvusmigrans				1								
Mimetillus moloneyi							1					
Mimosa pigra											1	
Miniopterus inflatus							1					
Miniopterus natalensis							1					
Mirafra africana							1					
Mirafra albicauda				1		1	1	1		1	1	1
Mirafra cantillans									1			
Mirafra rufocinnamomea			1				1					
Miscanthidium violaceum							1					
Miscanthus violceus					1							
Mochlus sundevallii							1					
Mochokus brevis			1	1								
Mochokus niloticus	1		1	1								1
Moina dubia												1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Monochoria africana	1			1	1		1	1		1	1	1
Monticola angolensis							1					
Monticola saxatilis							1		1			
Monticola solitarius									1			
Mops brachypterus							1					
Mops condylurus							1					
Mops nanulus							1					
Mops thersites							1					
Mops trevori							1					
Mormyridae									1			
Mormyrops anguilloides	1		1	1		1	1	1		1		1
Mormyrus caschive			1	1		1	1			1		
Mormyrus cashive												1
Mormyrus hasselquistii			1	1								
Mormyrus kannume	1		1	1	1	1	1	1	1	1	1	1
Mormyrus kanumme						1						
Mormyrus macrocephala							1					
Mormyrus macrocephalus						1	1					
Mormyrus niloticus			1	1		1				1		
Mortonagrion stygium										1		
Motacilla aguimp	1		1	1	1	1	1	1	1	1	1	1
Motacilla alba	1		1	1		1	1	1	1		1	1
Motacilla capensis						1	1			1	1	
Motacilla cinerea			1	1			1	1	1	1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Motacilla clara						1				1	1	
Motacilla flava	1		1	1	1	1	1	1	1	1	1	1
Mugil cephalus									1			
Mungos mungo	1						1					
Mus minutoides							1					
Mus musculoides							1					
Mus musculus				1		1			1			
Mus triton							1					
Muscicapa adusta							1					
Muscicapa aquatica	1				1	1	1			1	1	1
Muscicapa cassini						1				1		
Muscicapa striata							1		1	1		
Musophaga rossae							1					
Mutela bourguignati						1	1	1			1	
Mycteria ibis	1		1	1	1	1	1	1	1	1	1	1
Mylomys dybowskii							1					
Myonax sanguineus	1											
Myopterus whitleyi							1					
Myosorex blarina										1		
Myotis bocagii							1					
Myotis tricolor							1					
Myotis welwitschii							1					
Myriophyllum spicatum	1		1	1	2	1	1	1		1	1	1
Myrmecocichla arnotti							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Myrmecocichla nigra							1					
Naja										1		
Naja melanoleuca							1					
Naja nigricollis							1					
Najas graminea	1		1	1	1	1	1	1	1	1	1	1
Najas horrida							1					
Najas marina	1		1	1	1	1	1	1	1	1	1	1
Najas minor									1			
Najas pectinata	1		1	1	1	1	1	1	1	1		1
Najas schweinfurthii	1		1	1			1					1
Nandinia binotata	1						1					
Nanger granti							1					
Nanger soemmerringii				1								
Nannaethiops bleheri			1									
Nannaethiops unitaeniatus			1									1
Nannocharax niloticus				1			1					
Natriciteres olivacea	1		1	1	1	1	1	1		1	1	1
Natriciteres olivaceae							1					
Natrix tessellata									1			
Neafrapus cassini							1					
Necrocytres monachus				1								
Necrosyrtes monachus							1					
Necrosyrtes monochus						1					1	
Nectarinia kilimensis							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Nectarinia pulchella				1								
Nemacheilus abyssinicus						1						
Neobola bredoi										1		
Neobola nilotica			1	1								
Neocossyphus poensis							1					
Neodythemis klingi										1		
Neodythemis preussi					1		1			1		
Neophedina cincta	1			1	1	1	1	1		1	1	1
Neophron percnopterus	1		1	1	1	1	1	1	1	1	1	1
Neophron perconopterus											1	
Neoromicia capensis							1					
Neoromicia flavescens							1					
Neoromicia helios							1					
Neoromicia nana							1					
Neoromicia rendalli							1					
Neoromicia somalica							1					
Neoromicia tenuipinnis							1					
Neoromicia zuluensis							1					
Neotis denhami							1					
Neotis nuba									1			1
Nephila constricta							1					
Nephila fenestrata							1					
Nephila senegalensis							1					
Nephila sumptuosa							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Nephila turneri							1					
Nephilingis cruentata							1					
Nesciothemis farinosa	1		1	1	1	1	1	1	1	1	1	1
Nesciothemis nigeriensis	1											1
Nesocharis ansorgei					1		1			1		
Nesocharis capistrata	1					1				1		
Nesotragus moschatus							1					
Netta erythrophthalma			1		1	1	1	1		1	1	1
Netta rufina									1			
Nettapus auritus	1		1	1	1	1	1	1	1	1	1	1
Neurogomphus featheri	1					1		1		1	1	1
Nicator chloris							1					
Nigrita canicapillus							1					
Nigrita fusconotus							1					
Nilaus afer							1		1			
Nitia acuminata										1		
Nitia monceti							1	1			1	
Nitia teretiuscula				1					1			
Nothobranchius neumanni							1					
Nothobranchius robustus					1	1	1	1		1	1	
Nothobranchius sagittae							1	1				
Nothobranchius serengetiensis							1	1				
Nothobranchius sp							1					
Nothobranchius taeniopygus					1		1	1				

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Nothobranchius ugandensis				1	1		1	1		1	1	
Nothobranchius virgatus			1									
Nothobranchius virgatus,												1
Nothobranchus												1
Notiothemis jonesi				1	1		1	1		1	1	
Notiothemis robertsi				1	1		1	1		1	1	
Notogomphus dorsalis					1		1	1		1	1	
Notogomphus flavifrons										1		
Notogomphus lecythus						1	1				1	
Notogomphus leroyi				1	1		1	1		1	1	
Notogomphus lujai				1	1		1	1		1	1	
Notogomphus maathaiae					1		1				1	
Numara meliagris			1									
Numenius arquata			1	1	1	1	1	1	1	1		
Numenius phaeopus				1	1		1	1	1	1	1	
Numenius tenuirostris									1			
Numida meleagris							1			1		
Nycteris arge							1					
Nycteris aurita							1					
Nycteris hispida							1					
Nycteris macrotis							1					
Nycteris nana							1					
Nycteris thebaica							1					
Nycticorax nycticorax	1		1	1	1	1	1	1	1	1		1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Nympha caerulea						1						
Nymphaea caeruleus							1					
Nymphaea calliandra										1		
Nymphaea capensis							1					
Nymphaea lotus							1		1	1	1	1
Nymphaea nouchali	1		1	1	1	1	1	1	1	1	1	1
Nymphaea spontanea											1	
Nymphea						1						
Nymphoides brevipedicellata	1		1	1	1	1	1	1	1	1	1	1
Nymphoides forbesiana	1		1		1	1		1	1	1	1	1
Nymphoides indica	1		1	1	1	1	1	1	1	1	1	1
Nymphoides tenuissima										1		
Odaxothrissa vittata										1		
Oena capensis				1			1		1			
Oenanthe albifrons												1
Oenanthe cypriaca									1			
Oenanthe deserti									1			
Oenanthe familiaris							1					
Oenanthe hispanica									1			
Oenanthe isabellina							1		1			
Oenanthe leucopyga									1			
Oenanthe melanura									1			
Oenanthe moesta									1			
Oenanthe monacha									1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Oenanthe oenanthe	1		1	1	1	1	1	1	1	1	1	1
Oenanthe palustris							1					
Oenanthe pleschanka							1		1			
Oenanthe xanthoprymna									1			
Oenomys hypoxanthus							1					
Olpogastra lugubris	1		1	1	1	1		1		1	1	1
Onitis adelphus							1					
Onitis mendax							1					
Onitis monstrosus							1					
Onitis robustus							1					
Onthophagus jugicola							1					
Onthophagus juvencus							1					
Onthophagus lemekensis							1					
Onthophagus quadricuspis							1					
Onthophagus stigmosus							1					
Ontragus megaceros	1											
Onychognathus albirostris						1						
Onychognathus fulgidus							1					
Onychognathus morio					1	1	1	1		1	1	1
Onychognathus tenuirostris						1				1	1	
Onychogomphus nigrotibialis							1					
Onychogomphus styx										1	1	
Opsaridium ubangiense										1		
Orechromis niloticus					1							

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Oreochromis												1
Oreochromis aureus									1			
Oreochromis esculentus					1	1		1	1			
Oreochromis galilaeus									1			
Oreochromis ismailiaensis									1			
Oreochromis leucostictus					1	1		1	1	1		
Oreochromis niloticus	1		1	1	1		1	1	1	1	1	1
Oreochromis variabilis					1	1		1	1			
Oreolais pulcher										1	1	
Oreotragus oreotragus							1					
Oriolus auratus							1					
Oriolus brachyrynchus							1					
Oriolus larvatus			1		1	1		1	1	1	1	1
Oriolus oriolus							1		1			
Oriolus percivali							1					
Orthetrum abbotti	1		1		1	1	1	1	1	1	1	1
Orthetrum africanum										1		
Orthetrum austeni					1	1		1	1	1	1	
Orthetrum brachiale	1		1	1	1	1	1	1	1	1	1	1
Orthetrum caffrum			1		1	1		1	1	1	1	
Orthetrum camerunense					1	1		1	1	1	1	
Orthetrum chrysostigma	1		1	1	1	1	1	1	1	1	1	1
Orthetrum guineense			1		1	1		1	1	1	1	
Orthetrum hintzi			1		1	1		1	1	1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Orthetrum icteromelas	1				1	1		1	1		1	1	1
Orthetrum julia	1		1		1	1	1	1	1		1	1	1
Orthetrum kollmannspergeri				1			1						
Orthetrum kristenseni			1				1						
Orthetrum latihami	1												1
Orthetrum machadoi					1	1		1	1		1	1	
Orthetrum microstigma								1					
Orthetrum monardi	1		1		1	1	1	1	1		1	1	1
Orthetrum saegeri											1		
Orthetrum stemmale	1		1		1	1		1	1		1	1	1
Orthetrum trinacria	1		1	1	1	1	1	1	1	1	1	1	1
Orthochromis mazimeroensis					1								
Ortygospiza atricollis	1		1		1		1	1			1	1	1
Ortyxelos meiffrenii									1				
Orycteropus afer	1							1					
Oryza barthii	1		1	1	1		1	1	1				1
Oryza brachyantha	1		1	1	1			1	1		1		1
Oryza eichingeri					1	1		1	1		1	1	
Oryza glaberrima					1						1		
Oryza longistaminata	1		1	1	1	1	1	1	1		1	1	1
Oryza longistaminata													1
Oryza punctata	1		1	1	1	1	1	1	1		1	1	1
Osbornictis piscivora											1		
Otocyon megalotis								1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Otolemur crassicaudatus							1					
Otomops harrisoni							1					
Otomops martiensseni							1					
Otomys angoniensis											1	
Otomys tropicalis					1					1	1	
Ottelia alismoides	1		1	1	1	1	1	1	1	1	1	1
Ottelia brachyphylla												1
Ottelia fischeri					1	1		1		1	1	
Ottelia scabra	1				1	1	1	1		1	1	1
Ottelia ulvifolia							1					1
Ottelia verdickii					1		1	1		1	1	
Otus scops							1					
Otus senegalensis							1					
Ourebi aourebia				1								
Ourebia ourebi	1		1		1	1	1	1		1		1
Ouribia monfana	1											
Oxythemis phoenicosceles					1	1	1			1		
Oxyura maccoa										1		
Palpopleura deceptor	1		1	1	1	1	1	1		1	1	1
Palpopleura jucunda	1		1	1	1	1	1	1		1	1	1
Palpopleura lucia	1		1		1	1	1	1		1	1	1
Palpopleura portia	1		1		1	1	1	1		1	1	1
Paludipasser locustella							1				1	
Pan troglodytes schweinfurthii	1											

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Panaspis wahlbergi							1					
Pandion haliaetus	1		1	1	1	1	1	1	1	1	1	1
Panicum maximum			1		1							
Pantala flavescens	1		1	1	1	1	1	1	1	1	1	1
Panthera leo	1				1			1				1
Panthera pardus								1				
Papio anubis								1	1			
Papio cynocephalus								1				
Papio doguera	1											
Papioanubis				1								
Paracrocidura maxima										1		
Paraechinus aethiopicus				1					1			
Paragomphus alluaudi			1					1	1		1	
Paragomphus cognatus					1	1		1	1	1	1	
Paragomphus elpidius					1	1		1	1	1	1	
Paragomphus genei			1	1	1	1	1	1	1	1	1	
Paragomphus pumilio			1	1			1		1			1
Paragomphus sabicus								1	1		1	
Paragomphus serrulatus	1											1
Paragomphus viridior					1	1		1	1	1	1	
Parailia pellucida			1									
Paralabidochromis chilotes							1					
Paralabidochromis plagiodon							1					
Paralabidochromis sp							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Paralabidochromis victoriae							1					
Paralabidochromis'rock kribensis							1					
Paraxerus alexandri							1					
Paraxerus boehmi							1					
Parazyxomma flavicans					1	1	1	1		1	1	
Parmoptila jamesoni					1		1			1		
Paspalidium geminatun											1	
Passer domesticus				1			1		1		1	1
Passer eminibey							1					
Passer gongonensis							1					
Passer griseus							1		1			
Passer luteus									1			
Passer shelleyi							1					
Passer suahelicus							1					
Passer swainsonii				1								
Pelecanus crispus									1			
Pelecanus onocrotalus	1		1	1	1	1	1	1	1	1		1
Pelecanus rufescens	1		1	1	1	1	1	1	1	1		1
Peliperdix coqui							1					
Peliperdix lathami							1					
Pelomedusa subrufa							1					
Pelomys fallax							1					
Pelomys hopkinsi											1	
Pelomys isseli							1				1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Pelophylax bedriagae									1			
Pelusios rhodesianus							1					
Pelusios williamsi							1					
Pennisetum											1	
Pennisetum imperata cylindrica										1		
Pennisetum purpureum										1		
Pennisetum sp							1					
Pennisetum unisetum			1									
Pernis apivorus							1		1			
Pernis aprivorus										1		
Perodicticus ibeanus							1					
Petrocephalus bovei			1									
Petrocephalus castostoma											1	
Petrocephalus catostoma					1	1	1	1		1	1	
Petrocephalus degeni							1					
Petrodromus tetradactylus							1					
Phacochoerus aethiopicus				1						1		
Phacochoerus africanus	1						1					
Phalacrocorax africanus				1		1						
Phalacrocorax carbo	1		1	1	1	1	1	1	1	1		1
Phaneroptera minima									1			
Phaneroptera sparsa							1					
Phaon camerunensis										1		
Phaon iridipennis	1		1		1	1	1	1		1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Pharacrocorax africanus							1					
Phataginus tricuspis	1						1					
Phaulopsis angolana										1		
Phaulopsis imbricata	1		1	1		1						1
Phaulopsis micrantha	1											1
Philantomba monticola							1					
Philochortus zolii									1			
Philomachus pugnax				1		1	1					
Philothamnus battersbyi							1					
Philothamnus carinatus							1					
Philothamnus heterolepidotus							1					
Philothamnus irregularis				1								
Philothamnus nitidus loveridgei							1					
Philothamnus semivariegatus							1					
Philothamus irregularis										1		
Phlyctimantis verrucosus				1	1		1			1		
Phoeniconaias minor				1		1	1			1	1	
Phoenicopterus roseus							1	1	1		1	
Phoeniculus bollei							1					
Phoeniculus purpureus							1			1		
Phoeniculus somaliensis						1						
Phoenicurus ochruros									1			
Phoenicurus phoenicurus							1					
Phoenix reclenata				1								

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Phoenix reclinata				1								
Pholia sharpii							1					
Pholidornis rushiae							1					
Phragmites australis			1			1			1		1	
Phragmites communis												1
Phragmites karka							1					1
Phragmites kirkii											1	
Phragmites mauritianus							1			1	1	
Phrynobatrachus acridoides							1	1			1	
Phrynobatrachus auritus										1		
Phrynobatrachus bequaerti										1		
Phrynobatrachus bullans							1					
Phrynobatrachus dendrobates							1			1		
Phrynobatrachus graueri							1			1	1	
Phrynobatrachus gutturosus										1		
Phrynobatrachus keniensis											1	
Phrynobatrachus mababiensis							1					
Phrynobatrachus minutus						1						
Phrynobatrachus natalensis	1		1	1	1	1	1	1		1	1	1
Phrynobatrachus parvulus							1			1		
Phrynobatrachus perpalmatus	1		1									1
Phrynobatrachus rouxi							1					
Phrynobatrachus scheffleri					1						1	
Phrynobatrachus versicolor										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Phrynomantis bifasciatusis				1								
Phrynomantis microps	1											
Phyllastrephus albigularis							1					
Phyllastrephus cabanisi							1					
Phyllastrephus hypochloris				1			1			1	1	1
Phyllastrephus icterinus							1					
Phyllastrephus strepitans			1			1				1	1	
Phyllastrephus xavieri							1					
Phyllogomphus annulus										1		
Phyllogomphus coloratus										1		
Phyllogomphus selysi				1	1		1	1		1	1	
Phyllolais pulchella			1				1					
Phyllomacromia africana	1		1	1	1				1	1		1
Phyllomacromia aureozona				1	1		1	1		1	1	
Phyllomacromia bicristulata										1		
Phyllomacromia contumax				1	1		1	1		1	1	
Phyllomacromia kimminsi	1		1	1	1		1	1			1	1
Phyllomacromia melania				1	1		1	1		1	1	
Phyllomacromia overlaeti				1	1		1	1		1	1	
Phyllomacromia paula										1		
Phyllomacromia picta			1	1	1	1	1	1		1	1	
Phyllomacromia pseudafricana	1				1		1			1		1
Phyllomacromia sylvatica				1	1		1			1	1	
Phylloscopus budongoensis							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Phylloscopus collybita	1			1			1	1		1		1	1
Phylloscopus sibilatrix								1					
Phylloscopus trochilies										1			
Phylloscopus trochilus	1		1	1	1	1	1	1	1	1	1	1	1
Phymeurus fitzgeraldi								1					
Pila ovata	1		1	1	1	1	1	1	1	1	1	1	1
Piliocolobus tephrosceles								1					
Pinarocorys erythropygia									1				
Pinheyschna meruensis					1	1		1		1			
Pinheyschna rileyi					1	1		1	1	1	1		
Pipistrellus crassulus								1					
Pipistrellus grandidieri								1					
Pipistrellus hesperidus								1					
Pipistrellus nanulus								1					
Pipistrellus rueppellii								1					
Pirenella conica									1				
Pisidium casertanum			1				1						
Pisidium fistulosum								1	1			1	
Pisidium ovampicum						1	1	1		1		1	
Pisidium pirothi	1		1	1			1	1		1		1	1
Pisidium viridarium							1						
Pistia stratiotes	1		1	1	1	1	1	2	1	1	1		1
Pistia stratiotes					1								
Pitta angolensis					1	1		1	1		1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Pitta reichenowi							1					
Plangia graminea							1					
Planiliza macrolepis									1			
Planorbis planorbis									1			
Platalea alba	1		1	1	1	1	1	1	1	1		1
Platalea leucorodia	1		1						1			1
Platycypha caligata	1		1		1	1	1	1	1	1	1	1
Platycypha lacustris					1	1		1	1	1	1	
Platysteira cyanea							1			1		
Platysteira peltata							1					
Plectropterus gambensis	1		1	1	1	1	1	1	1	1	1	1
Plectropterus gambensis					1							
Plegadis falcinellus	1		1	1	1	1	1	1	1	1		1
Plocepasser mahali						1		1		1	1	1
Plocepasser superciliosus	1					1	1				1	1
Ploceus albinucha										1		
Ploceus aurantius								1				
Ploceus badius	1			1					1			1
Ploceus baglafecht			1		1	1	1	1		1	1	1
Ploceus castanops					1	1		1		1	1	
Ploceus cucullatus	1		1	1	1	1	1	1	1	1	1	1
Ploceus galbula				1								
Ploceus intermedius					1	1		1	1	1	1	
Ploceus jacksoni					1	1		1	1	1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Ploceus jacksonii							1					
Ploceus luteolus							1		1			
Ploceus manyar									1			
Ploceus melanocephalus	1				1		1	1		1	1	1
Ploceus melanogaster							1					
Ploceus nigerrimus							1					
Ploceus nigricollis							1					
Ploceus ocularis				1	1		1			1	1	
Ploceus olivaceiceps							1					
Ploceus pelzelni				1	1		1	1		1	1	
Ploceus spekeoides					1							
Ploceus superciliosus							1					
Ploceus taeniopterus	1		1	1			1		1			1
Ploceus tricolor					1		1			1		
Ploceus vitellinus							1					
Ploceus weynsi				1			1			1		
Ploceus xanthops				1	1		1	1		1	1	
Ploceus taeniopterus	1											
Pluchea bequaertii				1	1		1	1		1	1	
Pluvialis apricaria									1			
Pluvialis fulva											1	
Pluvianus aegyptius	1		1	1	1	1			1	1		1
Podica senegalensis	1		1	1	1	1	1			1		1
Podiceps cristatus					1	1		1	1	1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Podiceps nigricollis				1		1			1		1	
Poecilia reticulata							1					
Poecilictis libyca	1											
Poecilogale albinucha							1					
Poelagus marjorita larkeni	1											
Poeoptera stuhlmanni							1					
Pogoniulus bilineatus					1	1	1			1	1	1
Pogoniulus chrysoconus	1		1	1	1	1	1			1	1	1
Pogoniulus pusillus							1					
Pogoniulus scolopaceus							1					
Pogoniulus subsulphureus							1					
Pogonocichla stellata							1					
Pogonornis bidentatus							1					
Pogonornis rolleti	1											1
Poicephalus flavifrons						1						
Poicephalus meyeri							1					
Polemaetus bellicosus	1		1	1	1	1	1	1		1	1	1
Polihierax semitorquatus							1					
Pollimyrus isidori			1									
Pollimyrus nigricans					1	1		1	1	1	1	
Pollimyrus petherici			1	1			1			1		
Polyboroides typus	1		1	1	1	1	1	1	1	1	1	1
Polygonum											1	
Polygonum setosulum							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Polypterus												1
Polypterus bichir			1									
Polypterus senegalensis												1
Polypterus senegalus			1									
Poropanchax normani												1
Porpax garambensis	1									1		1
Porpax sentipes										1		
Porphyrio alleni	1		1	1	1	1	1	1	1	1	1	1
Porphyrio porphyrio				1	1	1	1	1	1	1		
Porzana porzana	1		1	1	1	1	1	1	1	1		1
Potamochoerus larvatus								1				
Potamogale velox								1		1	1	
Potamogeton crispus	1		1	1			1		1			1
Potamogeton lucens				1			1					
Potamogeton nodosus	1		1	1	1		1	1	1		1	1
Potamogeton octandrus	1		1	1	1	1	1	1		1	1	1
Potamogeton pectinatus								1	1	1	1	
Potamogeton perfoliatus	1		1	1			1		1			1
Potamogeton pusillus	1		1	1	1	1	1	1	1	1	1	1
Potamogeton schweinfurthii	1		1	1	1	1	1	1		1	1	1
Potamogeton thunmbergii								1				
Potamogeton trichoides	1		1	1	1	1	1	1	1	1	1	1
Potamonautes berardi				1	1	1		1		1		
Potamonautes congoensis										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Potamonautes dybowskii										1		
Potamonautes emini				1			1					
Potamonautes gerdalensis							1	1				
Potamonautes ignestii						1						
Potamonautes lirrangensis										1		
Potamonautes loashiensis				1								
Potamonautes loveni											1	
Potamonautes minor										1		
Potamonautes niloticus			1	1		1	1	1	1	1	1	1
Potamonautes rukwanzi										1		
Praomys jacksoni							1					
Prinia bairdii							1					
Prinia erythroptera							1					
Prinia gracilis									1			
Prinia rufifrons									1			
Prinia subflava	1		1	1	1	1	1	1	1	1	1	1
Prionops plumata							1					
Prionops plumatus							1					
Prionops poliolophus							1					
Proagoderus brucei							1					
Procambarus clarkii	1		1	1	1	1	1	1	1	1	1	1
Procavia capensis							1					
Procavia ruficeps	1											
Prodotiscus insignis							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Prodotiscus regulus							1					
Proischnura subfurcata				1	1	1	1	1		1	1	
Prosymna ambigua							1					
Proteles cristata							1					
Proteles cristatusatus	1											
Protopterus aethiopicus	1		1	1	1	1	1	1		1		1
Protopterus aethiopicus ssp. aethiopicus											1	
Protoxerus stangeri							1					
Psalidoprocne albiceps							1					
Psalidoprocne pristoptera			1		1	1	1	1		1	1	1
Psammomys obesus									1			
Psammophis mossambicus							1					
Psammophis olivacea										1		
Pseudagrion acaciae					1		1	1				
Pseudagrion bicoerulans						1	1				1	
Pseudagrion commoniae						1						
Pseudagrion emarginatum	1											1
Pseudagrion gamblesi			1				1	1			1	
Pseudagrion glaucescens					1	1	1	1		1	1	
Pseudagrion glaucum						1	1			1		
Pseudagrion hageni					1	1	1	1		1	1	
Pseudagrion hamoni	1		1	1	1	1	1	1		1	1	1
Pseudagrion kaffinum							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Pseudagrion kersteni	1		1		1	1		1	1		1	1	1
Pseudagrion kibalense						1		1	1		1	1	
Pseudagrion massaicum	1		1	1	1	1	1	1	1		1	1	1
Pseudagrion melanicterum					1	1		1	1		1	1	
Pseudagrion niloticum	1		1	1			1	1		1		1	1
Pseudagrion nubicum	1		1	1	1	1		1	1	1	1	1	1
Pseudagrion rufocinctum					1	1		1	1		1	1	
Pseudagrion salisburyense					1	1	1	1	1		1	1	
Pseudagrion serrulatum											1		
Pseudagrion sjoestedti	1		1	1	1	1		1	1		1	1	1
Pseudagrion spernatum			1		1	1	1	1	1		1	1	
Pseudagrion sublacteum	1		1	1	1	1	1	1	1		1	1	1
Pseudagrion sudanicum	1		1	1	1	1		1	1		1	1	1
Pseudagrion superbum											1		
Pseudagrion torridum	1		1	1	1	1		1	1	1	1	1	1
Pseudhirundo griseopyga			1		1	1	1	1	1		1	1	
Pseudocrenilabrus multicolor			1		1	1		1	1		1	1	
Pseudocrenilabrus multicolor ssp. multicolor			1										
Pseudocrenilabrus multicolor ssp. victoriae												1	
Pseudonigrita arnaudi								1					
Pseudorhynchus hastifer			1		1			1			1		1
Psittacula krameri	1			1					1				1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Psittacus erithacus							1	1				
Ptercolesexstus				1								
Pternistis afer							1					
Pternistis erckelii						1						
Pternistis harwoodi						1						
Pternistis hildebrandti							1					
Pternistis rufopictus							1					
Pternistis squamatus							1					
Pterocles decoratus							1					
Pterocles exustus							1		1			
Pterocles lichtensteinii				1					1			
Pterocles senegallus				1					1			
Pteronemobius monochromus							1					
Pteronetta hartlaubii										1		
Ptilopachus nahani							1					
Ptilopsis granti							1					
Ptilopsis leucotis									1			
Ptilostomus afer							1			1		1
Ptychadena anchiatae							1					
Ptychadena anchietae			1		1	1	1	1		1	1	1
Ptychadena baroensis			1									
Ptychadena bibroni	1											
Ptychadena christyi						1				1		
Ptychadena chrysogaster							1			1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Ptychadena mahnerti											1	
Ptychadena mascareniensis	1		1				1			1		1
Ptychadena mossambica							1					
Ptychadena neumanni						1						
Ptychadena nilotica	1		1	1	1	1	1	1	1	1	1	1
Ptychadena oxyrhynchus	1				1	1	1	1		1	1	1
Ptychadena porissisima							1					
Ptychadena porosissima					1		1	1			1	
Ptychadena pumilio	1		1	1		1						1
Ptychadena schillukorum	1		1	1	1	1	1	1	1		1	1
Ptychadena stenocephala							1					
Ptychadena taenioscelis					1		1	1			1	
Ptychadena tellinii	1		1	1								1
Ptychadena trinodis	1											
Ptychadena wadei						1						
Ptychromis sp							1					
Ptyonoprogne obsoleta						1			1			
Ptyonoprogne rufigula			1		1	1	1	1		1	1	1
Ptyonoprogne rupestris				1			1		1			
Pulicaria arabica			1	1			1		1			1
Pulicaria inuloides			1	1			1		1			
Pulicaria vulgaris									1			
Pycerus mundtii					1							
Pycnonotus barbatus	1		1	1	1	1	1	1	1	1	1	1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Pycreus lanceus							1					
Pycreus mortonii					1							
Pycreus nuerensis	1			1	1		1			1		
Pyrenestes ostrinus							1					
Pyrrhurus scandens				1	1		1			1		1
Python sebae						1	1				1	
Pytilia afra							1					
Pytilia melba							1					
Pytilia phoenicoptera												1
Pyxicephalus adspersus											1	
Pyxichromis para-orthostoma							1					
Quelea cardinalis							1					
Quelea erythrops			1		1		1			1	1	
Quelea quelea				1			1			1		
Radix auricularia									1			
Radix natalensis	1		1	1		1	1	1	1	1	1	1
Raiamas moorii										1		
Raiamas senegalensis			1	1		1			1			1
Rallus aquaticus									1			
Rallus caerulescens					1	1	1	1		1	1	
Ranalisma humile	1		1	1	1		1			1		1
Ranunculus multifidus							1					
Raphicerus campestris							1					
Rastineobola argentea											1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Rastrineobola argentea					1		1	1			1	
Rattus rattus				1	1	1	1	1	1	1	1	1
Recurvirostra	1											
Recurvirostra avosetta			1	1	1	1	1	1	1	1	1	1
Redunca arundinum				1			1					
Redunca redunca			1	1			1					1
Remiz pendulinus									1			
Rhabdomys dilectus							1					
Rhadina orientalis									1			
Rhadina sibilatrix									1			
Rhampholeon boulengeri							1					
Rhaphidura sabini				1	1		1			1		
Rhinacanthus virens										1		
Rhinolophus eloquens							1					
Rhinolophus fumigatus							1					
Rhinolophus hildebrandtii							1					
Rhinolophus landeri							1					
Rhinopomastus castaneiceps							1					
Rhinopomastus cyanomelas							1					
Rhinopomastus minor							1				1	1
Rhinoptilus chalcopterus							1					
Rhinoptilus cinctus							1					
Rhinotyphlops brevis							1					
Rhinotyphlops lineolatus							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Rhipsalis baccifera							1					
Rhizophora mucronata							1					
Rhynchocyon cirnei							1					
Rhynchops flavirostris							1					
Rhyothemis fenestrina					1	1	1	1		1	1	
Rhyothemis notata										1		
Rhyothemis semihyalina	1		1		1	1	1	1		1	1	1
Riparia paludicola			1	1	1	1	1	1	1	1	1	
Riparia riparia	1		1	1	1	1	1	1	1	1		1
Riparia riparia					1							
Rostratula benghalensis	1		1	1	1	1	1	1	1	1	1	1
Rotala gerardii	1									1		1
Rotala robynsiana	1									1		1
Rotala smithii	1									1		1
Rottboellia exaltata			1									
Rougetius rougetii						1						
Rousettus aegyptiacus							1					
Ruppia maritima									1			
Ruspolia ampla							1					
Ruspolia flavovirens							1					
Ruwenzorisorex suncoides										1		
Rynchops flavirostris	1		1	1	1	1	1	1	1	1		1
Saccharum spontaneum			1						1			
Sagittaria guayanensis	1		1	1								1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Sagittarius serpentarius							1					
Sarkidiornis melanotos	1		1	1	1	1	1	1	1	1		1
Sarotherodon												1
Sarotherodon galilaeus			1									1
Sarothrura affinis											1	
Sarothrura boehmi										1	1	
Sarothrura elegans					1	1		1		1	1	1
Sarothrura lugens										1		
Sarothrura pulchra					1	1		1		1	1	
Sarothrura rufa					1	1		1		1	1	
Saxicola rubetra								1				
Saxicola torquatus			1	1	1	1	1	1	1	1	1	1
Schilbe intermedius			1		1	1		1	1	1		
Schilbe mystus			1			1		1	1	1	1	
Schilbe uranoscopus			1	1								
Schismaderma carens					1			1	1			
Schistolais leucopogon					1	1		1		1	1	
Schoenicola brevirostris	1				1	1		1		1	1	1
Schoenoplectus corymbosus									1			
Schoenoplectus tabernaemontani									1			
Schoenoplectus triqueter									1			
Schoutedenapus myoptilus						1		1		1	1	
Sclerophrys channingi										1		
Sclerophrys funerea						1		1		1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Sclerophrys garmani											1	
Sclerophrys gutturalis							1	1			1	
Sclerophrys kassasii									1			
Sclerophrys kerinyagae						1					1	
Sclerophrys kisoloensis										1	1	
Sclerophrys pentoni	1			1								1
Sclerophrys pusilla	1				1	1	1	1		1	1	1
Sclerophrys regularis	1		1	1		1	1		1	1	1	1
Sclerophrys steindachneri	1		1			1	1			1		1
Sclerophrys vittata						1	1			1		
Sclerophrys xeros				1								
Scleroptila levaillantii							1					
Scleroptila streptophora							1					
Scopus umbretta	1		1	1	1	1	1	1		1	1	1
Scotocerca inquieta									1			
Scotoecus albofuscus							1					
Scotopelia bouvieri										1		
Scotopelia peli			1	1		1	1	1		1	1	1
Scotophilus dinganii							1					
Scotophilus leucogaster							1					
Scotophilus nux							1					
Scotophilus viridis							1					
Scutisorex somereni							1					
Securinega virosa				1								

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Segmentorbis angustus					1		1		1	1	1	
Senegalia brevispica			1									
Senna											1	
Serinus koliensis											1	
Serinus mozambicus				1						1		
Sesbania bispinosa				1			1	1			1	
Sesbania rostrate												1
Sesbania sesban							1					
Setaria kagerensis				1								
Sheppardia cyornithopsis							1					
Sheppardia polioptera							1					
Siluranodon auritus			1	1								
Smithornis capensis							1					
Smutsia gigantea							1					
Smutsia temminckii							1					
Smutsornis africanus							1					
Solanum nigra											1	
Solea vulgaris									1			
Sonchus macrocarpus									1			
Sorghum verticilliflorum				1								
Spartina alterniflora							1					
Spartina anglica							1					
Spartina maritima							1					
Spartina townsendii							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Spatula clypeata			1	1	1	1	1	1	1	1	1	1
Spatula hottentota			1		1	1	1	1	1		1	1
Spatula querquedula	1		1	1	1	1	1	1	1	1	1	1
Spermestes bicolor					1	1		1		1	1	
Spermestes cucullata	1		1		1	1	1	1	1		1	1
Spermestes fringilloides								1				
Spermophaga ruficapilla								1				
Sphaeranthus africanus											1	
Sphaeranthus chandleri					1	1		1	1		1	
Sphaeranthus steetzii			1	1	1	1		1	1		1	
Sphaeranthus ukambensis			1		1	1		1	1		1	
Sphaerium nyanzae								1	1		1	
Sphaerium regularis								1	1		1	
Sphaerium stuhlmanni								1	1		1	
Sphaerium victoriae						1		1	1		1	
Sphaerothylax abyssinica			1	1	1	1	1	1	1		1	1
Spilopelia senegalensis								1				
Spiloptila clamans									1			
Spirodela polyrhiza	1		1	1	1	1	1	1	1	1	1	1
Sporobolus pyramidalis					1							1
Sporobolus spicatus										1		
Sporopipes frontalis								1				
Spreo superbus								1				
Steatomys gazellae	1											

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Steatomys parvus							1					
Stelgidillas gracilirostris							1					
Stenandrium guineense										1		
Stenocypha jacksoni					1		1			1	1	
Stenocypha molindica				1						1		
Stephanoaetus coronatus			1	1	1	1	1	1		1	1	
Sterna albifrons							1					
Sterna nilotica							1					
Sternula albifrons									1			
Stiphrornis xanthogaster							1					
Stizorhina fraseri				1	1		1			1		
Streptopelia capicola				1	1		1	1		1	1	
Streptopelia decipiens	1		1	1	1	1	1	1	1	1	1	1
Streptopelia roseogrisea									1			
Streptopelia semitorquata	1		1	1	1	1	1	1		1	1	1
Streptopelia senegalensis				1					1			
Strix woodfordii							1					
Struthio camelus				1					1			
Stuckenia pectinata	1		1	1	1	1	1	1	1	1	1	1
Sudanonautes floweri	1											1
Suddia sagittifolia												1
Sumtsia temminckii	1											
Suncus hututsi							1					
Suncus megalura							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Suncus murinus				1			1	1	1			
Sylvia abyssinica							1					
Sylvia atricapilla							1		1			
Sylvia boehmi							1					
Sylvia borin				1			1		1			
Sylvia communis							1					
Sylvia curruca			1			1			1			1
Sylvia nisoria							1					
Sylvicapra grimmia							1					
Sylvietta brachyura							1		1			
Sylvietta leucophrys							1					
Sylvietta virens							1					
Sylvietta whytii							1					
Sylvisorex johnstoni							1					
Sylvisorex vulcanorum										1		
Syncerus caffer	1		1	1	1	1		1	1		1	1	1
Syncerus caffer caffer				1								
Syndontis afrofischeri											1	
Syndontis victoriae											1	
Syngnathus abaster									1			
Synobipesspps				1								
Synodontis						1						1
Synodontis afrofischeri					1	1		1			1	
Synodontis batensoda			1	1			1					1

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Synodontis caudovittatus			1	1								
Synodontis clarias			1	1		1			1			
Synodontis eupterus			1	1								
Synodontis filamentosus			1	1								
Synodontis frontosus			1	1		1		1	1		1	
Synodontis khartoumensis				1						1		
Synodontis membranaceus												1
Synodontis nigrita			1	1						1		
Synodontis ruandae					1							
Synodontis schall			1									1
Synodontis serratus			1	1								1
Synodontis sorex		1	1	1								1
Synodontis victoriae					1	1		1	1		1	
Synodontis victorianus							1					
Synodotis frontosus												1
Synoicus adansonii					1	1		1	1		1	1
Syzygium guineense							1					
Tachybaptus ruficollis			1	1	1	1	1	1	1	1	1	
Tachymarptis aequatorialis					1					1	1	
Tachymarptis melba		1	1	1	1	1	1	1	1	1		1
Tachyoryctes splendens							1					
Tadarida fulminans							1					
Tadarida ventralis							1					
Tadorna ferruginea				1		1			1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Tadorna tadorna									1			
Tamiscus emini gazellae	1											
Taphozous mauritianus							1					
Taphozous nudiventris				1					1			1
Taphozous perforatus	1			1					1	1		1
Tatera emini	1											
Tatera macropus	1											
Taterillus emini							1					
Tauraco leucolophus	1					1	1			1	1	1
Tauraco livingstonii							1					
Tauraco schuettii							1					
Tchagra australis							1					
Tchagra senegalus							1		1			
Telacanthura ussheri						1	1			1		
Terapon jarbua									1			
Terathopius ecaudatus							1			1		
Terpsiphone batesi										1		
Terpsiphone rufiventer							1					
Terpsiphone viridis							1			1		
Testudo kleinmanni									1			
Tetraodon lineatus			1	1					1			
Tetrathemis camerunensis					1	1	1	1		1	1	
Tetrathemis corduliformis						1	1	1		1	1	
Tetrathemis denticauda										1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Tetrathemis polleni				1	1		1	1		1	1	
Tetrathemis ruwensoriensis										1		
Thalassornis leuconotus	1		1	1	1	1	1	1		1	1	1
Thallomys paedulcus							1					
Thamnolaea cinnamomeiventris							1					
Thelypteris totta				1			1					
Themeda savanna										1		
Themeda triandra				1								
Thermochoria equivocata				1	1		1	1		1	1	
Thermochoria jeanneli							1	1			1	
Thermocyclops neglectus												1
Thermodiaptomus galebi												1
Thevetia peruviana											1	
Tholymis tillarga	1		1	1	1	1	1	1	1	1	1	1
Thoracochromis albertianus										1		
Thoracochromis avium										1		
Thoracochromis bullatus										1		
Thoracochromis mahagiensis										1		
Thoracochromis wingatii			1	1								1
Thos adustus	1											
Thrasops jacksonii							1					
Threskiornis aethiopicus	1		1	1	1	1	1	1	1	1		1
Thryonomys gregorianus			1		1	1	1	1		1	1	
Thryonomys swinderianus	1				1	1	1	1		1	1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Tigriornis leucolopha										1		
Tilapia				1								
Tilapia ismailiaensis									1			
Tilapia rendallii							1					
Tilapia zilli									1			
Tilapia zillii							1					
Tockus deckeni							1					
Tockus erythrorhynchus							1		1			
Tockus nasutus									1	1		
Tocus erthrorynchus				1								
Tomogonus crassus							1					
Tomopterna cryptotis	1		1	1								1
Tomopterna luganga							1					
Tomopterna marmorata											1	
Tomopterna tuberculosa							1					
Torgos tracheliotos							1		1			
Trachylaemus purpuratus					1		1			1	1	
Trachylepis bayonii							1					
Trachylepis maculilabris							1					
Trachylepis quiquetaeniata							1					
Trachylepis striata							1					
Trachylepis varia							1					
Trachyphonus margaritatus				1					1			
Trachyphonus usambiro							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Tragelap husstrepsiceros				1								
Tragelaphus oryx							1					
Tragelaphus scriptus	1						1					
Tragelaphus spekii	1				1	1	1	1		1		1
Tragelaphus strepsiceros							1					
Tramea basilaris	1		1		1	1	1	1		1	1	1
Tramea limbata	1		1		1	1	1	1		1	1	1
Trapa natans	1		1	1	1	1	1	1		1	1	1
Trapa natans					1							
Treron calvus							1					
Trianga glareola										1		
Trianga ochropus	1				1	1	1		1	1	1	1
Tricholaema diademata							1					
Tricholaema hirsuta							1					
Tricholaema lacrymosa							1					
Trigonoceps occipitalis						1	1				1	
Tringa erythropus	1		1	1	1	1	1	1	1	1	1	1
Tringa glareola	1		1	1	1	1	1	1	1	1	1	1
Tringa hypoleucos				1								
Tringa nebularia	1		1	1	1	1	1	1	1	1	1	1
Tringa ochropus	1		1	1	1	1	1	1	1	1	1	1
Tringa ocropus				1								
Tringa stagnatilis	1		1	1	1	1	1	1	1	1	1	1
Tringa tetanus							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Tringa totanus			1	1	1	1	1	1	1		1	
Trioceros bitaeniatus							1					
Trioceros ellioti							1					
Trionyx triunguis	1		1	1			1		1	1		1
Trithemis aconita			1		1	1		1	1		1	1	1
Trithemis aenea						1		1			1		
Trithemis annulata	1		1	1	1	1	1	1	1	1	1	1	1
Trithemis arteriosa	1		1	1	1	1	1	1	1	1	1	1	1
Trithemis dichroa	1				1	1		1	1		1	1	1
Trithemis donaldsoni			1		1	1	1	1	1		1	1	
Trithemis dorsalis					1	1		1	1		1	1	
Trithemis ellenbeckii			1				1						
Trithemis furva	1		1	1	1	1	1	1	1		1	1	1
Trithemis grouti					1	1		1	1		1	1	
Trithemis hecate	1		1		1	1		1	1		1	1	1
Trithemis imitata	1		1			1	1	1	1		1	1	1
Trithemis integra					1	1		1	1		1	1	
Trithemis kalula	1												1
Trithemis kirbyi	1		1	1	1	1	1	1	1	1	1	1	1
Trithemis nuptialis					1	1		1	1		1	1	
Trithemis pluvialis					1	1		1	1			1	
Trithemis pruinata	1				1	1		1	1		1	1	1
Trithemis stictica	1		1	1	1	1	1	1	1		1	1	1
Trithemis tropicana											1		

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Trithemis werneri				1	1		1	1		1	1	1
Trithetrum navasi	1			1	1		1	1		1	1	1
Triumffeta											1	
Trochocercus bivittatus							1					
Trochocercus nitens					1		1			1		
Tropodiaptomus												1
Turdoides hartlaubii										1		
Turdoides jardineii				1	1		1	1		1	1	
Turdoides leucocephala			1						1			
Turdoides leucopygia			1			1						
Turdoides plebejus							1			1		
Turdoides sharpei				1	1		1	1		1	1	
Turdus abyssinicus			1	1		1	1			1	1	
Turdus libonyana							1					
Turdus pelios							1					
Turdus philomelos									1			
Turnix nanus							1					
Turnix sylvaticus							1					
Tursiops truncatus									1			
Turtur abyssinicus	1		1	1		1				1		1
Turtur afer							1					
Turtur chalcospilos				1			1					
Turtur tympanistria							1					
Tylopsis continua							1					

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Tylopsis rubrescens							1					
Typha capensis					1	1		1	1	1	1	
Typha domingensis	1		1	1	1	1	1	1	1	1		1
Typha elephantina			1	1			1		1			
Typha latifolia	1		1	1	1	1	1	1		1	1	1
Tyto alba	1		1	1	1	1	1	1	1	1	1	1
Tyto capensis							1			1	1	
Ueplectes nigroventris							1					
Umma longistigma										1		
Umma saphirina						1	1			1	1	
Upupa africana				1								
Upupa epops							1		1			
Uraeginthis angolensis							1					
Uraeginthus bengalus				1			1		1	1		
Uraeginthus cyanocephalus							1					
Uranomys ruddi							1					
Urocolius macrourus			1	1	1	1	1	1	1	1	1	1
Urolestes melanoleucus							1					
Uromanis longicaudata	1											
Urothemis assignata	1		1		1	1		1	1		1	1
Urothemis edwardsii	1		1	1	1	1	1	1	1		1	1
Ursus arctos									1			
Urticularia thoningii										1		
Utricaularia gibbosa					1							

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Utricaularia inflexa				1								
Utricularia bracteata	1									1		1
Utricularia inflexa				1								
Utricularia microcalyx	1									1		1
Vallisnera												1
Vallisneria aethiopica										1		
Vallisneria spiralis	1		1	1	2	1	1	1	1	1	1	1
Vanellus albiceps	1					1				1		
Vanellus coronatus								1				
Vanellus crassirostris	1		1		1	1		1	1	1	1	1
Vanellus gregarius	1			1					1			1
Vanellus leucurus				1					1			1
Vanellus lugubris					1	1		1	1	1	1	
Vanellus senegallus	1		1	1	1	1	1	1	1	1	1	1
Vanellus spinosus	1		1	1	1	1	1	1	1	1		1
Vanellus superciliosus					1	1		1	1	1	1	
Vanellus tectus	1		1	1			1					1
Varanus albigularis										1		
Varanus niloticus							1		1	1		
Varicorhinus beso				1			1					
Varicorhinus ruandae					1							
Varicorhinus ruwenzori										1		
Vernonia glabra							1					
Vidua chalybeata							1		1			

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Vidua chalybeate				1								
Vidua fischeri							1					
Vidua funerea							1					
Vidua macroura	1		1	1	1	1	1	1		1	1	1
Vidua macrroura							1					
Vidua obtusa							1					
Vidua paradisaea							1					
Vidua purpurascens							1					
Vidua wilsoni	1		1									1
Vigna luteola												1
Vossia cuspidata					1		1			1	1	1
Vulpes pallida	1											
Vulpes vulpes									1			
Vulpus vulpus									1			
Wolffia arrhiza	1		1	1	1	1	1	1		1	1	1
Wolffiella hyalina	1		1	1	1	1	1	1	1	1	1	1
Xanthum pungens											1	
Xenobarbus loveridgei							1					
Xenoclarias											1	
Xenoclarias eupogon							1	1			1	
Xenoligea montana											1	
Xenomystus nigri				1								
Xenopus borealis								1			1	
Xenopus clivii						1						

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Xenopus epitropicalis										1		
Xenopus fischbergi										1		1
Xenopus laevis victorianus							1				1	
Xenopus lenduensis										1		
Xenopus muelleri				1			1	1				
Xenopus pygmaeus										1		
Xenopus ruwenzoriensis										1		
Xenopus vestitus										1		
Xenopus victorianus				1	1		1	1		1	1	1
Xenopus wittei										1		
Xenus cinereus									1			
Xerus erythropus leucombrinus	1											
Xerus rutilus							1					
Xyris capensis						1						
Xyris exigua	1									1		1
Xyris gossweileri	1									1		1
Xyris sanguinea	1									1		1
Xystichromis phytophagus							1					
Yssichromis fusiformis							1					
Yssichromis laparogramma							1					
Zabalius ophthalmicus							1					
Zaireichthys rotundiceps				1	1		1	1		1	1	
Zannichellia palustris	1		1	1	1	1	1	1	1	1	1	1
Zantedeschia albomaculata				1			1	1			1	

Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Zapornia flavirostra	1		1	1	1	1	1	1	1	1	1	1
Zapornia parva	1		1	1		1	1		1			1
Zapornia pusilla					1	1	1	1	1	1		
Zehneria minutiflora												1
Zelotomys hildegardeae					1	1		1	1	1	1	
Zenaida macroura	1											
Zosteraeschna ellioti					1	1		1	1	1	1	
Zosterops senegalensis								1		1		
Zygonoides fraseri	1					1				1		1
Zygonoides fuelleborni								1	1		1	
Zygonoides occidentis										1		
Zygonyx flavicosta										1		
Zygonyx natalensis	1		1		1	1	1	1	1	1	1	1
Zygonyx regisalberti					1					1		
Zygonyx torridus	1		1		1	1		1	1	1	1	1
Zygophyllum aegyptium									1			
Zyxomma atlanticum					1	1		1	1	1	1	
Total:	603		598	592	754	768	521	1982	816	580	1071	980	695

Annex 2 – Count of taxa within each wetland and taxon group that has a notable IUCN threat status

Count of Species	IUCN Threat Status					
Wetlands	Critically Endangered	Endangered	Vulnerable	Near Threatened	Conservation Dependent	Grand Total
Bahr el Ghazal	3	4	11	13	3	34
Birds	1	1	4	8		14
Mammals		3	4	3	3	13
Plants	2		2	2		6
Reptiles			1			1
Baro/Akobo Sobat Wetlands (Machar Marshes)	1	4	13	17	3	38
Birds		2	5	11		18
Fish				2		2
Insects			1			1
Mammals		2	3	3	3	11
Plants			2	1		3
Reptiles	1		2			3
Dinder	4	3	13	16	2	38
Birds	2	1	7	13		23
Mammals	1	2	4	2	2	11
Plants				1		1
Reptiles	1		2			3
Kagera	3	4	10	19	2	38
Birds		2	4	10		16
Fish	3	1	2	2		8
Insects			1	1		2
Mammals			3	4	2	9
Plants		1		2		3
Lake Kyoga	3	6	9	18	2	38
Birds		2	4	11		17

Count of Species	IUCN Threat Status					
Wetlands	Critically Endangered	Endangered	Vulnerable	Near Threatened	Conservation Dependent	Grand Total
Fish	3					3
Insects		1	2	1		4
Mammals		1	2	3	2	8
Mollusks				2		2
Plants		2	1	1		4
Lake Tana	3	3	17	15		38
Birds	3	2	6	12		23
Fish		1	6			7
Insects			1			1
Mammals			1	2		3
Plants			1	1		2
Reptiles			1			1
Shrimps			1			1
Lake Victoria	58	19	49	36	1	163
Birds	4	7	10	18		39
Fish	46	4	23	2		75
Insects		1	2	1		4
Mammals	1	1	11	9	1	23
Mollusks	6	4	1	3		14
Plants		2	1	2		5
Reptiles	1					1
Shrimps			1	1		2
Mara	47	7	31	16	1	102
Birds	1	4	5	8		18
Fish	46	2	23	1		72
Mammals			1	3	1	5
Mollusks		1	1	1		3

Count of Species	IUCN Threat Status					
Wetlands	Critically Endangered	Endangered	Vulnerable	Near Threatened	Conservation Dependent	Grand Total
Plants				2		2
Shrimps			1	1		2
Nile Delta	5	6	6	19		36
Birds	4	4	5	17		30
Fish	1					1
Mammals				1		1
Plants				1		1
Reptiles		2	1			3
Semliki	5	12	18	32	2	69
Amphibians	1			1		2
Birds		4	6	13		23
Fish	1	1	5	2		9
Insects			1	2		3
Mammals		3	3	5	2	13
Mollusks	1	2		4		7
Plants	2	2	2	5		11
Reptiles			1			1
Sio Nzoia Yala Nyando	50	9	36	20	1	116
Birds	3	3	8	8		22
Fish	43	1	23			67
Insects		1	1	1		3
Mammals			2	4	1	7
Mollusks	4	2	1	4		11
Plants		2	1	2		5
Shrimps				1		1
Sudd	4	4	15	18	3	44
Birds	1	2	6	10		19

Count of Species	IUCN Threat Status					
Wetlands	Critically Endangered	Endangered	Vulnerable	Near Threatened	Conservation Dependent	Grand Total
Fish				1		1
Mammals		2	4	4	3	13
Plants	2		3	3		8
Reptiles	1		2			3
Grand Total	186	81	228	239	20	754

Annex 3 – Flagship species for each wetland / wetland complex

Species	Common Name	Bahr el Ghazal	Machar Marshes	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Acrocephalus griseldis	Basra Reed Warbler			1				1		1			1
Agriocnemis palaeforma	Papyrus Wisp				1	1		1			1		
Anas acuta	Northern Pintail	1		1	1	1	1	1	1	1	1	1	1
Anastomus lamelligerus	African Openbill	1		1	1	1	1	1	1	1	1	1	1
Anguilla anguilla	European Eel									1			
Aonyx capensis	African Clawless Otter	1		1	1	1	1	1	1		1	1	1
Aonyx congicus	Congo Clawless Otter										1		
Ardeola idae	Madagascar Pond-Heron					1	1		1	1		1	
Atilax paludinosus	Marsh Mongoose	1		1	1	1	1	1	1	1	1	1	1
Aythya ferina	Northern Pochard	1		1	1		1	1		1	1		1
Aythya nyroca	Ferruginous Pochard	1		1	1			1		1			1
Balaeniceps rex	Shoebill	1		1		1	1		1	1		1	1	1
Balearica pavonina	Black Crowned Crane	1		1	1			1					1
Balearica regulorum	Grey Crowned Crane					1	1		1	1		1	1	
Bradypterus graueri	Grauer's Swamp-warbler										1		
Calamonastides gracilirostris	Papyrus Yellow Warbler					1			1	1		1	1	
Ceratotherium simum	Square-lipped Rhinoceros							1					
Crocodylus niloticus	Nile Crocodile	1		1	1	1	1	1	1		1		1

Species	Common Name	Bahr el Ghazal	Machar Marshes	Dinder	Kagera		Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Cyclanorbis elegans	Nubian Flapshell Turtle			1	1									1
Cyclanorbis senegalensis	Sahelian Flapshell Turtle			1	1									1
Dendroaspis polylepis	Black Mamba								1					
Diceros bicornis	Hook-lipped Rhinoceros				1				1					
Gallinago media	Great Snipe		1	1	1	1	1	1	1	1	1	1	1	1
Glareola nordmanni	Black-winged Pratincole		1	1	1		1				1	1		1
Haematopus ostralegus	Pied Oystercatcher										1			
Heterobranchus longifilis	Vundu Catfish			1	1		1		1	1	1	1	1	1
Hippopotamus amphibius	Hippopotamus		1	1	1	1	1	1	1	1		1	1	1
Hydrocynus vittatus	Tigerfish			1	1		1		1			1		
Hyperolius chrysogaster	Goldbelly Reed Frog											1		
Hyperolius cinnamomeoventris	Cinnamon-bellied Reed Frog						1		1			1	1	
Kobus kob	White-eared Kob		1	1			1					1		1
Kobus kob ssp. leucotis	White-Eared Kob			1										
Kobus megaceros	Nile Lechwe		1	1										1
Labeo victorianus	Ningu					1	1		1	1		1		
Limnotragus spekei	Sitatunga		1											
Limosa limosa	Black-tailed Godwit		1	1	1	1	1	1	1	1	1	1	1	1
Loxodonta africana	African Elephant		1	1	1	1	1		1			1	1	1
Marmaronetta angustirostris	Marbled Teal										1			

Species	Common Name	Bahr el Ghazal	Machar Marshes	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Nettapus auritus	African Pygmy Goose		1		1	1	1	1	1	1	1	1	1
Numenius tenuirostris	Slender-billed Curlew									1			
Ontragus megaceros	Nile Lechwe		1										
Oreochromis esculentus	Graham's Tilapia					1	1		1	1			
Oreochromis variabilis	Victoria Tilapia					1	1		1	1			
Oxyura maccoa	Erismature Maccoa										1		
Pan troglodytes schweinfurthii	Long-haired Chimpanzee		1										
Panthera leo	African Lion		1			1			1				1
Panthera pardus	Leopard								1				
Pelecanus crispus	Dalmatian Pelican									1			
Pelecanus onocrotalus	Great White Pelican		1		1	1	1	1	1	1	1		1
Pelecanus rufescens	Pink-backed Pelican		1		1	1	1	1	1	1	1		1
Phoeniconaias minor	Lesser Flamingo					1		1	1		1	1	
Python sebae	African Rock Python							1	1			1	
Pyxicephalus adspersus	Giant Bullfrog											1	
Rynchops flavirostris	African Skimmer		1		1	1	1	1	1	1	1		1
Scotopelia peli	Pel's Fishing Owl				1	1		1	1	1	1	1	1
Spatula clypeata	Northern Shoveler				1	1	1	1	1	1	1	1	1
Spatula hottentota	Hottentol Teal				1		1	1	1	1	1	1	1
Spatula querquedula	Garganey		1		1	1	1	1	1	1	1	1	1
Tragelaphus spekii	Sitatunga		1			1	1		1	1		1	1

Species	Common Name	Bahr el Ghazal	Machar Marshes	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd
Trionyx triunguis	Nile Softshell Turtle		1	1	1		1			1	1		1
Vanellus gregarius	Sociable Lapwing		1		1					1			1

Annex 4 – Umbrella and Keystone species for each wetland / wetland complex

Count of Species	Wetland												
	Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd	Total
Species	9	11	11	11	11	7	18	10	6	13	12	15	134
African buffalo	1	1	1	1	1		1	1		1	1	1	10
Syncerus caffer	1	1	1	1	1		1	1		1	1	1	10
African Elephant	1	1	1	1	1		1			1	1	1	9
Loxodonta africana	1	1	1	1	1		1			1	1	1	9
Cattail	1	1	1	2	2	1	2	2	2	2	1	1	18
Typha capensis				1	1		1	1	1	1	1		7
Typha domingensis	1	1	1	1	1	1	1	1	1	1		1	11
Common Reed		1				1	2		1	1	3	2	11
Phragmites australis		1				1			1		1		4
Phragmites communis												1	1
Phragmites karka							1					1	2
Phragmites kirkii											1		1
Phragmites mauritianus							1			1	1		3
Elephant Grass											1	1	2

Count of Species	Wetland												
	Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd	Total
Echinochloa pyramidalis											1	1	2
Hippo grass					1		1			1	1	1	5
Vossia cuspidata					1		1			1	1	1	5
Hippo Grass; Bougou												1	1
Echinochloa stagnina												1	1
Hippopotamus	1	1	1	1	1	1	1	1		1	1	1	11
Hippopotamus amphibius	1	1	1	1	1	1	1	1		1	1	1	11
Hook-lipped Rhinoceros			1				1						2
Diceros bicornis			1				1						2
Nile Perch		1	1		1	1	1	1	1	1		1	9
Lates niloticus		1	1		1	1	1	1	1	1		1	9
Papyrus	1	1	1	1	1	1	1	1	1	1		1	11
Cyperus papyrus	1	1	1	1	1	1	1	1	1	1		1	11
Sitatunga	1												1
Limnotragus spekei	1												1
Square-lipped Rhinoceros							1						1

Count of Species	Wetland												
	Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Dinder	Kagera	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudd	Total
Ceratotherium simum							1						1
Tigerfish		1	1		1		1			1			5
Hydrocynus vittatus		1	1		1		1			1			5
Water Hyacinth				1			1		1		1	1	5
Eichhornia crassipes				1			1		1		1	1	5
Wild Rice	3	3	3	4	2	2	4	4		3	2	3	33
Oryza barthii	1	1	1	1		1	1	1				1	8
Oryza brachyantha	1	1	1	1			1	1		1		1	8
Oryza eichingeri				1	1		1	1		1	1		6
Oryza longistaminata	1	1	1	1	1	1	1	1		1	1	1	11
Grand Total	9	11	11	11	11	7	18	10	6	13	12	15	134

Annex 5 – Indicator species for each wetland / wetland complex

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
	121	130	130	141	137	120	176	128	108	159	134	138	1622
Amphibians	4	4	2	7	7	2	14	7		11	11	5	74
0				2	1		4	2		1	1	1	12
Bubbling Kassina	1	1	1	1	1	1	1	1		1	1	1	11
Cinnamon-bellied Reed Frog					1		1			1	1		4
East African Puddle Frog							1	1			1		3
Marble-legged Frog	1	1		1	1		1	1		1	1	1	9
Medje River Frog							1			1			2
Rugege River Frog							1			1	1		3
White-lipped Frog				1	1		1			1	1		5
African Clawed Frog							1				1		2
Giant Bullfrog											1		1
Goldbelly Reed Frog										1			1
Groove-crowned Bullfrog	1	1	1	1	1		1	1		1	1	1	10
Lendu Plateau Clawed Frog										1			1
Natal River Frog	1	1		1	1	1	1	1		1	1	1	10

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
Birds	72	79	86	79	82	84	90	75	78	87	72	76	960
Abdim's Stork	1	1	1	1	1	1	1	1	1	1	1	1	12
African Comb Duck	1	1	1	1	1	1	1	1	1	1		1	11
African Darter	1	1	1	1	1	1	1	1	1	1	1	1	12
African Fish Eagle	1	1	1	1	1	1	1	1	1	1	1	1	12
African Jacana	1	1	1	1	1	1	1	1	1	1	1	1	12
African Openbill	1	1	1	1	1	1	1	1	1	1	1	1	12
African Pygmy Goose	1	1	1	1	1	1	1	1	1	1	1	1	12
African Sacred Ibis	1	1	1	1	1	1	1	1	1	1		1	11
African Skimmer	1	1	1	1	1	1	1	1	1	1		1	11
African Spoonbill	1	1	1	1	1	1	1	1	1	1		1	11
Allen's Gallinule	1	1	1	1	1	1	1	1		1	1	1	11
Avocet	1												1
Baillon's crake				1	1	1	1	1	1	1			7
Basra Reed Warbler		1					1		1			1	4
Black Crowned Crane	1	1	1			1						1	5
Black-crowned Night Heron	1	1	1	1	1	1	1	1	1	1		1	11
Black-headed Heron	1	1	1	1	1	1	1	1	1	1	1	1	12
Black-necked Grebe			1			1			1		1		4
Black-tailed Godwit	1	1	1	1	1	1	1	1	1	1	1	1	12

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
Black-winged Pratincole	1	1	1		1				1	1		1	7
Black-winged Stilt	1	1	1	1	1	1	1	1	1	1	1	1	12
Caspian Plover	1	1	1	1	1	1	1	1	1	1	1	1	12
Common Coot			1						1				2
Common Greenshank	1	1	1	1	1	1	1	1	1	1	1	1	12
Common Moorhen			1	1	1	1	1	1	1	1	1		9
Common Redshank		1	1	1	1	1	1	1	1		1		9
Common Reed Warbler	1	1	1	1	1	1	1	1	1	1	1	1	12
Common Ringed Plover	1	1	1	1	1	1	1	1	1	1	1	1	12
Common sand piper			1										1
Common sandpiper	1	1	1	1	1	1	1	1	1	1	1	1	12
Common Snipe	1	1	1	1	1	1	1	1	1	1	1	1	12
Common Teal		1	1	1	1	1	1	1	1	1	1	1	11
Corncrake	1	1	1	1	1	1	1	1	1	1	1	1	12
Egyptian goose	1	1	1	1	1	1	1	1	1	1	1	1	12
Erismature maccoa										1			1
Eurasian Bittern	1	1	1						1			1	5
Eurasian Curlew		1	1	1	1	1	1	1	1	1			9

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
Ferruginous Pochard	1	1	1			1			1			1	6
Fulvous tailed whistling ducks							1						1
Fulvous Whistling-duck	1	1		1	1	1	1	1		1	1	1	10
Gaint Kingfisher	1	1	1	1	1	1	1	1		1	1	1	11
Garganey	1	1	1	1	1	1	1	1	1	1	1	1	12
Glossy Ibis	1	1	1	1	1	1	1	1	1	1		1	11
Goliath Heron	1	1	1	1	1	1	1	1	1	1	1	1	12
Grauer's Swamp-warbler										1			1
Great Cormorant	1	1	1	1	1	1	1	1	1	1		1	11
Great Snipe	1	1	1	1	1	1	1	1	1	1	1	1	12
Green Sandpiper	2	1	2	2	2	2	1	2	2	2	2	2	22
Green-backed Heron	1	1	1	1	1	1	1	1	1	1	1	1	12
Grey Crowned Crane				1	1		1	1		1	1		6
Grey Heron	1	1	1	1	1	1	1	1	1	1	1	1	12
Grey-headed Kingfisher	1	1	1	1	1	1	1	1	1	1	1	1	12
Half-collared Kingfisher		1		1		1	1						4
Hamerkop	1	1	1	1	1	1	1	1		1	1	1	11
Jack Snipe	1	1	1		1	1	1		1	1	1	1	10
Kittlitz's Plover	1	1	1	1	1	1	1	1	1	1	1	1	12
Lesser Flamingo				1		1	1			1	1		5
lesser jacana	1	1	1		1		1			1	1	1	8

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
Little Crake	1	1	1		1	1			1			1	7
Little Grebe		1	1	1	1	1	1	1	1	1	1		10
Little Ringed Plover	1	1	1	1	1	1	1	1	1	1	1	1	12
Little stint	1	1	1	1	1	1	1	1	1	1	1	1	12
Long-tailed Cormorant	1	1	1	1	1	1	1	1	1	1	1	1	12
Madagascar Pond-Heron				1	1		1	1		1	1		6
Malachite Kingfisher	1	1	1	1	1	1	1	1	1	1	1	1	12
Mallard			1						1				2
Marbled Teal									1				1
Marsh Sandpiper	1	1	1	1	1	1	1	1	1	1	1	1	12
Marsh Warbler		1	1			1			1				4
Northern Pintail	1	1	1	1	1	1	1	1	1	1	1	1	12
Northern Pochard	1	1	1		1	1			1	1		1	8
Northern Shoveler		1	1	1	1	1	1	1	1	1	1	1	11
painted snipe	1	1	1	1	1	1	1	1	1	1	1	1	12
Papyrus Canary				1	1		1			1	1		5
Papyrus Gonolek			1	1	1		1			1	1		6
Papyrus Yellow Warbler				1			2	1		1	2		7
Pel's fishing owl		1	1			1	1	1		1	1	1	8
Pied Kingfisher	1	1	1	1	1	1	1	1	1	1	1	1	12
Pied Oystercatcher									1				1

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
Purple Heron	1	1	1	1	1	1	1	1	1	1	1	1	12
Purple Swamphen / gallinule			1	1	1	1	1	1	1	1			8
Red-billed Teal	1	1	1	1	1	1	1	1	1	1	1	1	12
Redshank							1						1
Reed cormorant			1			1	1						3
River Warbler	1	1	1	1	1	1	1	1	1	1	1	1	12
Rock Pratincole			1		1	1	1		1	1			6
Ruddy Shelduck			1			1			1				3
Ruff	1	1	2	1	1	2	2	1	1	1	1	1	15
Saddle-bill Stork	1	1	1	1	1	1	1	1	1	1	1	1	12
Sedge Warbler	1	1	1	1	1	1	1	1	1	1	1	1	12
Shoebill	1	1		1	1		1	1		1	1	1	9
Slender-billed Curlew									1				1
Spotted Crake	1	1	1	1	1	1	1	1	1	1		1	11
spotted redshank	1	1	1	1	1	1	1	1	1	1	1	1	12
Spur-winged Goose	1	1	1	1	1	1	1	1		1	1	1	11
Squacco heron	1	1	1	1	1	1	1	1	1	1	1	1	12
Striped Kingfisher							1			1			2
Swamp Flycatcher	1			1	1		1			1	1	1	7
Temminck's Stint	1	1	1	1	1	1	1	1	1	1	1	1	12
White-backed duck	1	1	1	1	1	1	1	1		1	1	1	11

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
White-faced whistling duck	1	1	1	1	1	1	1	1	1	1	1	1	12
wood sandpiper	1	1	1	1	1	1	1	1	1	2	1	1	13
Woodland Kingfisher	1	1	1	1	1	1	1	1		1	1	1	11
Yellow-billed Duck		1		1	1	1	2	1		1	1	1	10
Yellow-billed Stork	1	1	1	1	1	1	1	1	1	1	1	1	12
Fish	2	3	3	6	6	1	6	6	3	7	5	3	51
0				3	3		4	3		3	4	1	21
African catfish	1	1	1	1	1	1	1	1	1	1		1	11
African lung fish	1	1	1	1	1			1		1		1	8
Egyptian mouth brooder		1		1	1		1	1		1	1		7
European eel									1				1
Gormut			1						1				2
lungfish										1			1
Insects				1	2		2			1	1		7
Maathai's Longleg					1		1				1		3
Papyrus Wisp				1	1		1			1			4
Mammals	15	9	7	7	7	3	12	6	1	10	6	10	93
African Clawless Otter	1	1	1	1	1	1	1	1		1	1	1	11
Cane rat	1			1	1		1	1		1	1		7
Congo Clawless Otter										1			1

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
Defassa Waterbuck	1												1
Defassa Waterbuck							1						1
Hippopotamus	1	1	1	1	1	1	1	1		1	1	1	11
Hook-lipped Rhinoceros			1				1						2
Marsh Mongoose	1	1	1	1	1	1	1	1		1	1	1	11
Nile Lechwe	2	1										1	4
Otter									1				1
Reedbuck		1	1				1					1	4
Roan Antelope	1	1	1				1					1	5
Sitatunga	2			1	1		1	1		1		1	8
Speckle-throated Otter	1	1		1	1		1	1		1	1	1	9
Spotted neck otter										1	1		2
Warthog	1						1						2
Waterbuck	1	1	1	1			1			1		1	7
Web-footed otter	1												1
White-eared kob	1	1			1					1		1	5
Plants	26	31	28	40	32	28	50	33	25	41	39	40	413
0	16	19	17	28	19	17	31	21	12	27	24	21	252
Cattail	2	2	2	3	3	2	3	3	2	3	2	2	29
Common Reed		1				1	2		1	1	3	2	11
Curled Pondweed	1	1	1			1			1			1	6

Count of Species	Wetland Bahr el Ghazal	Baro/Akobo Sobat Wetlands (Machar Marshes)	Din der	Kag era	Lake Kyoga	Lake Tana	Lake Victoria	Mara	Nile Delta	Semliki	Sio Nzoia Yala Nyando	Sudc	Total
Duckweed		1	1		1	1	1	1	1			1	8
Elephant Grass											1	1	2
Hippo grass					1		1			1	1	1	5
Hippo Grass; Bougou												1	1
Juncus									1				1
Lotus Water Lily							1		1	1	1	1	5
Papyrus	1	1	1	1	1	1	1	1	1	1		1	11
Rigid Hornwort					1		1		1	1	1	1	6
Spiny water nymph	1	1	1	1	1	1	1	1	1	1	1	1	12
Water Hyacinth				1			1		1		1	1	5
Water lettuce	1	1	1	1	1	1	2	1	1	1		1	12
Water Lily	1	1	1	1	2	1	1	1	1	1	1	1	13
Water lily											1		1
Wild Rice	3	3	3	4	2	2	4	4		3	2	3	33
Reptiles	2	4	4	1	1	2	2	1	1	2		4	24
African lung fish							1						1
Nile crocodile	1	1	1	1	1	1	1	1		1		1	10
Nile Softshell Turtle	1	1	1			1			1	1		1	7
Nubian Flapshell Turtle		1	1									1	3
Sahelian Flapshell Turtle		1	1									1	3
Grand Total	121	130	130	141	137	120	176	128	108	159	134	138	1622

Where 0 denotes the absence of a common name.

Annex 6 – Habitat types, characteristics and diversity

Generic Habitat Characteristics	Habitat Types & Description								
Dominant vegetation unit	Open water Vegetation (Aquatic)	Papyrus Marsh (permanent)	Reed beds (Phragmites)	River flooded Grassland	Shrubland	Swamp	Mud flats	Seepage Wetlands	Woodland
Substrate / Soil	any	fine	Fine / coarse	Fine / coarse	Fine / coarse	Usually fine	Usually fine	fine	any
Habitat variants	Open water [slow, fast, channel (perennial, seasonal), permanent pools (includes oxbows), seasonal pools, shallow lake, lagoon]	Permanently inundated, low flow velocities fringe marsh, grass, Papyrus or floating Papyrus mats	Reeds and bulrush (Typha) patches or beds, mutually exclusive usually	Seasonally flooded floodplains (grassland)	Mostly floodplains or patches, less flooded than grasslands, or rainfall dependent	Permanently inundated, medium to tall woody dominated	Seasonal or cyclical, mostly not vegetated, always wet or in shallow water.	hillslope, gradient, rain fed seeps, grasses	Beyond flood zone, mostly terrestrial
Flood duration	permanent, slow	permanent, slow	spans both permanently and seasonally flooded zones	seasonal, about 90 days in the wet season	Seasonal, periodic, shorter duration than grasslands	permanent, slow	seasonal, cyclical, slow, wind buffeted	rain dependent, with catenal seepage	never or rarely
Flood depth (preference range but can withstand extremes	>1.5m for rooted species, not applicable to	Can be various but Papyrus generally limited by	0.5-1.3m (opt range for distribution but can	0 in the dry season, optimally 1 - 1.5m during floods, but up	0 to 0.5m for shirt durations	variable, 0.5 to 2m with gentle seasonal fluctuations	shallow to just wet, dynamic, cyclical	n/a	0, phreatophytic (dependent on soil water)

Generic Habitat Characteristics	Habitat Types & Description								
Dominant vegetation unit	Open water Vegetation (Aquatic)	Papyrus Marsh (permanent)	Reed beds (Phragmites)	River flooded Grassland	Shrubland	Swamp	Mud flats	Seepage Wetlands	Woodland
beyond range e.g. during flooding)	floating species	prolonged flooding below 1.5m, although can withstand much deeper flooding for shorter periods	withstand deeper flooding for shorter periods)	to 2m, steep decline beyond 1.5m					
Anthropogenic importance	Dredging, shipping, loss of biodiversity	Low agricultural value	Low agricultural value	Rice, sugarcane grazing	crops, grazing wood collection	wood collection	prawn harvesting	Grazing, crops	Forestry, deforestation fire wood

Generic Habitat Characteristics	Habitat Types & Description								
Dominant vegetation unit	Open water Vegetation (Aquatic)	Papyrus Marsh (permanent)	Reed beds (Phragmites)	River flooded Grassland	Shrubland	Swamp	Mud flats	Seepage Wetlands	Woodland
Ecological note	This ecotype is dominated by free-floating-leaved plants like *Eichhornia crassipes, Lemna gibba, Azolla nilotica* and *Nymphaea lotus* as well as submerged vegetation e.g. *Potamogeton, Trapa and Ceratophyllum* spp in both flowing waters and lakes. Microphytes are prevalent in lakes but less so in the flowing turbid	These occur on land that is flooded throughout the year. Dominated along the banks of the river by massive stands of Cyperus papyrus, Vossia cuspidata, Typha domingensis. Associates of the Cyperus swamp are climbers and ferns.	The shallow flooded species- *Phragmites communis, Echinochloa pyramidalis*, and *Oryza barthii* ~ are limited to sites where the maximum depth of flooding does not exceed 130 cm.	These grasslands are seasonally flooded to varying extent and depth by the river. During the rainy season the plains of this belt are often swampy and completely covered with luxuriant growth of tall grasses. Species composition and biomass is closely linked to soil type and degree of inundation. The tall grasses are dominated by	Usually occur as patchy higher-lying areas within a matrix of flooded grassland or as a zone beyond the flooding of the grasslands but distinct from the taller wooded (tree) areas.	Swampland includes mangrove swamps, a diverse habitat type	Important habitat for waders (birds)	Seep areas usually demarcate the outer edge of wetlands or can be isolated. Almost always dominated by grasses different from immediately surrounding areas	It is quite distinct from the grass plains being higher in level. It is the well drained areas around the floodplains. This rain fed belt is an open mixed Acacia forest supporting several species of trees and shrubs and a luxuriant growth of grasses. The tree vegetation is dominated by Acacia seyal, Acacia sieberiana

Generic Habitat Characteristics	Habitat Types & Description								
Dominant vegetation unit	Open water Vegetation (Aquatic)	Papyrus Marsh (permanent)	Reed beds (Phragmites)	River flooded Grassland	Shrubland	Swamp	Mud flats	Seepage Wetlands	Woodland
	waters of the main channel.			Phragmites, Sorghum, Hyparrhenia and Setaria spp as well as Oryza and Echinochloa. Two grassland types are recognized. These are wild rice grassland dominated by Oryza longistaminata and Echinochloa grassland dominated by Echinochloa pyramidalis. Sedges, herbs and other grasses such as Sporobolus pyramidalis associate with the Oryza					and Balanites aegyptiaca. The tree vegetation is an important source of firewood and building poles. Balanites has additional food and medicinal values. It is the most utilized ecotype for settlement, crop production and wet season grazing

Generic Habitat Characteristics	Habitat Types & Description								
Dominant vegetation unit	Open water Vegetation (Aquatic)	Papyrus Marsh (permanent)	Reed beds (Phragmites)	River flooded Grassland	Shrubland	Swamp	Mud flats	Seepage Wetlands	Woodland
				grassland. It is the most productive grassland type in terms of year-round grazing for livestock and wildlife because of the high protein content of dead materials of wild rice grass. The Echinochloa grassland associates with Oryza and legumes like Desmodium hirtum.					

Generic Habitat Characteristics	Habitat Types & Description								
Dominant vegetation unit	Open water Vegetation (Aquatic)	Papyrus Marsh (permanent)	Reed beds (Phragmites)	River flooded Grassland	Shrubland	Swamp	Mud flats	Seepage Wetlands	Woodland
Main representing species	Floating: Water hyacinth (Eichornia crassipes), Water lettuce (Lemna giba); Rooted: Water Lily (Nymphae lotus)	Fringe Vegetation characterised by bands of Vossia cuspidata or Echinochloa stagnina, usually followed by Papyrus (Cyperus papyrus)	Phragmites australis	Echinochloa pyramidalis, and Oryza barthii (also Phragmites but seperated in col E)			Mostly unvegetated, wading birds	Grass dominated, e.g. Imperata cylindrica	Vachellia (Acacia) seyal, V. sieberiana, Balanites aegyptiaca

Annex 7 – Important Birds Areas associated with chosen transboundary wetlands

Note: The data / information in the column "Key Biodiversity" are replicated here from the BirdLife International (2019) website for the convenience of the reader, who is referred directly to their site for more complete and comprehensive coverage of IBAs (http://datazone.birdlife.org/site/mapsearch).

Wetland	Name	Key Biodiversity
Nile Delta	Lake Manzala	Manzala is by far the most important wetland for wintering waterbirds in Egypt, holding a total of 233,901 waterbirds in winter 1989/90. This represented c.40% of all waterfowl counted throughout Egypt's wetlands that winter and included the world's largest concentrations of wintering Larus minutus and Chlidonias hybridus. There were also up to 36,180 waders present in spring 1990, indicating the great importance of the wetland for populations of passage migrants, especially of Recurvirostra avosetta, Calidris minuta, Calidris alpina and Philomachus pugnax. No similar counts are available for autumn, but the lake is likely to be as important in that season. Manzala is also of importance for a number of breeding waterbirds and wetland species. About 35 species are known to breed, including Ixobrychus minutus, Egretta garzetta, Ardeola ralloides, Porphyrio porphyrio, Sterna albifrons, Charadrius alexandrinus, Vanellus spinosus, Glareola pratincola, Caprimulgus aegyptius, Ceryle rudis and Acrocephalus stentoreus. For some of these species, Manzala is one of the most important breeding areas in the entire western Palearctic region. Non-bird biodiversity: Reptiles: The Mediterranean shore of the lake is a potential breeding site for endangered marine turtles. Caretta caretta (EN) is the species most likely to breed in the area. Mammals: Felis chaus is still known to occur in good numbers.
Nile Delta	Lake Burullus	Burullus is one of Egypt's most important wetland for wintering waterfowl, holding a total of 98,887 in winter 1989/90, the second-largest concentration recorded in Egypt that winter. The lake supports the largest numbers of some wintering waterfowl in the country, including Anas penelope, Anas clypeata, Aythya nyroca, Aythya ferina, Fulica atra and Tringa totanus. Burullus is one of the most important wintering grounds for Aythya nyroca in the eastern Mediterranean. Because of its relative isolation, Burullus is also an important breeding site for several waterbirds and wetland species. About 35 species of birds are known to breed, of which the most prominent are Tachybaptus ruficollis, Ixobrychus minutus, Porphyrio porphyrio, Sterna albifrons, Charadrius alexandrinus, Vanellus spinosus, Glareola pratincola, Caprimulgus aegyptius, Ceryle rudis, Centropus senegalensis and Acrocephalus stentoreus. The endemic delta subspecies of Calandrella rufescens (Calandrella rufescens nicolli) probably has its largest population in the vicinity of Burullus.

Wetland	Name	Key Biodiversity
		Non-bird biodiversity: Reptiles: the Mediterranean shore of the lake is a potential breeding site for endangered marine turtles—Caretta caretta (EN) is known to breed locally. Mammals: Felis chaus is known to occur in numbers.
Nile Delta	Lake Idku	Lake Idku is of moderate importance for both wintering and breeding waterbirds. In winter 1989/90, a total of 22,549 waterbirds was counted. The lake probably also supports important numbers of breeding birds associated with reed-swamps, such as Porphyrio porphyrio, Ixobrychus minutus and Centropus senegalensis.
Nile Delta	Lake Maryut	The importance of Lake Maryut for birds has diminished greatly over the last two or three decades, due to habitat loss, ecological changes and increased disturbance and hunting pressure. Numbers of wintering waterbirds are modest; in winter 1989/90, a total of about 10,000 waterbirds was counted. Little is known about the lake's importance for staging of migrants. Several waterbirds are known to breed, including Tachybaptus ruficollis, Porphyrio porphyrio, Gallinula chloropus, Ixobrychus minutus, Charadrius alexandrinus and Sterna albifrons. Little is known, also, about the numbers involved, but it is not expected that there would be any significant concentrations, with the exception of the population of Sterna albifrons, which is in the order of 150 pairs.
Nile Delta	Wadi El Natrun	Wadi El Natrun is of modest importance for waterbirds. In winter 1989/90 a total of c.7,700 waterbirds was counted. Wadi El Natrun is known to hold some of the largest winter concentrations in Egypt of Tadorna tadorna, Gallinago gallinago, Numenius arquata, Calidris minuta and Charadrius alexandrinus. However, with the exception of the latter, none are known to occur in internationally significant numbers. The area is also of moderate importance for migrant waterbirds; in spring 1990 a total of c.7,800 waders was counted (including some resident species). The area might be more important for staging migrants during autumn. Grus grus is known to pass through and rest in significant numbers during spring and autumn. Some 12 species of waterbirds are known or expected to breed in Wadi El Natrun, including the largest breeding population of Charadrius pecuarius known in Egypt. Marmaronetta angustirostris previously bred in Wadi El Natrun, at least until 1912. There is no recent indication of breeding. The last observation of the species in Wadi El Natrun was in 1986 and it is unlikely that it will breed again unless disturbance and hunting pressure are curbed. Non-bird biodiversity: Flora: Typha elephantina, one of the prominent components of marsh flora in Wadi Natrun, is known nowhere else in Egypt. After being considered extinct in Egypt, Papyrus Cyperus papyrus was rediscovered in Wadi El Natrun at Lake Um Risha in 1971, where the only remaining wild stand in the country is reported. Reptiles: this is the only known locality where the rare Philochortus

Wetland	Name	Key Biodiversity
		zolli is found in Egypt. Mammals: Gazella leptoceros (EN) has occurred in the desert habitats of Wadi El Natrun, but has become extirpated from the region during the past three decades. The apparently rare endemic shrew, Crocidura floweri (EN), was last recorded from Wadi El Natrun.
Dinder wetlands	Dinder (Dinder National Park)	There are few detailed bird records for Dinder. Given, however, the extent and quality of the habitat, it is likely that more species characteristic of the Sudan–Guinea Savanna biome (A04) will be found to occur. One species of the Sahel biome (A03) has been recorded (see Table 2). Non-bird biodiversity: The following mammals of global conservation concern occur, or used to do so: Loxodonta africana (EN), Panthera leo (VU), Acinonyx jubatus (VU), Hyaena hyaena (LR/nt), Crocuta crocuta (LR/cd), Giraffa camelopardalis (LR/cd), Syncerus caffer (LR/cd), Redunca arundinum (LR/cd), Hippotragus equinus (LR/cd), Kobus ellipsiprymnus (LR/cd), Tragelaphus strepsiceros (LR/cd), Damaliscus lunatus (LR/cd), Ourebia ourebi (LR/cd) and Gazella rufifrons (VU). The park provides only dry-season habitat for most of these species.
Dinder wetlands	Gezira	The site is important for wintering and passage waterbirds. It is likely that at least 20,000 waterbirds occur during most northern winters. Counts of 1,000 Anas querquedula, 3,000 Philomachus pugnax and 1,000 Glareola pratincola were made at single localities during the winters of 1959–1962. Other counts include up to 2,000 Ciconia ciconia. Birds forage widely across the grass plains while some congregate in large roosts, particularly on sandbanks in the Blue Nile at Wad Medani.
Lake Tana wetlands	Bahir Dar - Lake Tana	This site is particularly important for waterbirds, some of which occur in large numbers. In combination, numbers are thought to exceed 20,000 seasonally. A detailed count was made in December 1993. Speciesthat occurred in particularly high numbers included Phalacrocorax carbo, Anhinga rufa (98+), Mesophoyx intermedia, Threskiornis aethiopicus, Dendrocygna bicolor and D. viduata. Other waterbirds of interest noted in substantial numbers include Anastomus lamelligerus and Grus grus. Grus pavonina, Larus ichthyaetus, Larus cachinnans and Egretta gularis occur in smaller numbers, and both Botaurus stellaris and Podica senegalensis have been recorded. In addition Bahr Dar has the most northerly records in Ethiopia of Sarothrura rufa. A number of globally threatened species occur: Grus carunculatus, seen irregularly in small numbers; Phoenicopterus minor, whose numbers fluctuate unpredictably; Rougetius rougetii, resident in small numbers; Circus macrourus, fairly common during migration time, with a few overwintering; and Aquila clanga, recorded at the site but rare. A survey in March 1996 recorded 217 species, and more are known to occur. Asio abyssinicus, Parus leuconotus, Serinus xanthopygius and Lybius undatus are notable among the Afrotropical Highlands biome species. In addition, two Sudan–Guinea Savanna biome species have been recorded; see Table 3. Other species

Wetland	Name	Key Biodiversity
		of interest include Nectarinia kilimensis, which has been reported on a number of occasions, and Lagonosticta rufopicta, which is fairly common. Ceratogymna brevis nests in the large figs around the lake, including in the grounds of the larger hotels in Bahr Dar, and both Picoides obsoletus and Cisticola eximia are known from the area to the west of Lake Tana.
Baro/Akobo Sobat Wetlands (Machar Marshes)	Boma	Balaeniceps rex breeds in the Guom swamps. There are few bird records for the area but, in addition to those listed below, four species characteristic of the Sudan–Guinea Savanna biome (A04) and four of the Afrotropical Highland biome (A07) have been recorded (see Table 2). The former includes the only Sudan record of Cossypha albicapilla and the latter the only one of C. semirufa. Non-bird biodiversity: Up to one million Kobus kob leucotis (LR/cd) migrate through the park annually. Other mammals of global conservation concern that occur, or which used to, include Loxodonta africana (EN), Acinonyx jubatus (VU), Damaliscus lunatus (LR/cd), Syncerus caffer (LR/cd), Hippotragus equinus (LR/cd), Giraffa camelopardalis (LR/cd), Redunca redunca (LR/cd), Gazella thomsoni (LR/cd), G. granti (LR/cd), Oryx beisa (LR/cd) and Alcelaphus buselaphus (LR/cd).
Baro/Akobo Sobat Wetlands (Machar Marshes)	Gambella National Park	More than 230 species have been recorded in the park. Balaeniceps rex was recorded in the early 1960s, 20 km west of Gambella. There are recent anecdotal reports of the species breeding in the Abobo area, suggesting that it may be present seasonally in swamps within the park. Acrocephalus griseldis was recorded regularly between 1969 and 1976, but its current status is unknown. Sudan–Guinea Savanna biome species include: Merops bulocki, Eremomela pusilla, Cisticola ruficeps, C. troglodytes, Plocepasser superciliosus, Lagonosticta larvata and Vidua interjecta, the last-named being known in Ethiopia only from around Gambella. Three Afrotropical Highlands and four Somali–Masai biome species have been recorded. Other species include Platalea leucorodia (rarely recorded from the south and west of Ethiopia), Kaupifalco monogrammicus (little-known in Ethiopia), Campethera cailliautii and Acrocephalus melanopogon. The only Ethiopian record of Vanellus crassirostris is from Gambella.
Baro/Akobo Sobat Wetlands (Machar Marshes)	Baro River	In the dry season, when the Baro river is low, huge numbers of storks and other waterbirds (including pelicans, herons, egrets, etc.) gather to rest on sandbars in the river. A flock of 500 Glareola nordmanni, apparently wintering, was noted at Jikawo in January 1970. Balaeniceps rex was recorded from swamps 20 km west of Gambella in the early 1960s, and was also found 60 km west of the western perimeter of Gambella National Park, west of Gog, in 1973. There is an unconfirmed 1996 report of B. rex breeding in the vicinity of Nasir in West Nile province, Sudan, adjacent to Jikawo, and large numbers have been reported from the Baro river system in Sudan, suggesting that the species may be present on the

Wetland	Name	Key Biodiversity
		Ethiopian side of the border close to Nasir. During March 1976, thousands of Anastomus lamelligerus were recorded between Itang and Jikawo, and similar numbers of Ciconia abdimii were found between Pukwo and Jikawo. The latter species is thought to be an irregular non-breeding visitor.
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	The Sudd swamps hold by far the largest population of Balaeniceps rex. Aerial surveys in 1979–1982 counted a peak of 6,407 individuals. The site is probably also important for Aythya nyroca and, on passage, for Falco naumanni. In addition to those listed below, three species characteristic of the Sahel biome (A03) and five of the Somali–Masai biome (A08) have also been recorded (see Table 2). Non-bird biodiversity: Mammals of global conservation concern include Loxodonta africana (EN), Panthera leo (VU), Giraffa camelopardalis (LR/cd), Damaliscus lunatus (LR/cd), Gazella thomsoni (LR/cd), Kobus megaceros (LR/nt), K. kob (LR/cd), K. ellipsiprymnus (LR/cd), Redunca redunca (LR/cd), Syncerus caffer (LR/cd), Ourebia ourebi (LR/cd), Hippotragus equinus (LR/cd) and Tragelaphus spekii (LR/nt).
Bahr el Ghazal wetlands	none	none that include notable wetlands
Lake Kyoga wetlands	Lake Nakuwa	There has been little fieldwork done in and around Lake Kyoga, although during two visits by NatureUganda staff, some apparently important places for the conservation of birds were noted. There is no list of birds in the Kyoga system, but records have been made in different parts of the swamp. These include Lake Nawampasa, part of Lake Nakuwa and Kyebiseke around Irundu. The swamps are mainly important for three species of global conservation concern, and for species of the Lake Victoria Basin biome Non-bird biodiversity: Mammals include otters and Tragelaphus spekii (LR/nt). Some of the small lakes in the Kyoga area support rare species of fish, including some that were exterminated in Lakes Victoria and Kyoga by the introduced and predatory Lates niloticus.
Lake Kyoga wetlands	Lake Bisina	Ploceus spekeoides appears to be common in the vicinity of water, at least during the breeding season. A total of 47 nests were counted in early August 1996, but it has not been recorded breeding since. The type-specimen was obtained from Nariam in central Teso. However, the swamp around Nariam has since been drained. The status of this species is not well-known, but its distribution seems to be restricted to the north-eastern part of Uganda. There have been unconfirmed records from Rhino Camp in Arua and south of Lake Kyoga near Nakasongola.Ploceus castanops breeds extensively in the short papyrus fringing the lake. Other notable papyrus species include Bradypterus carpalis, Cisticola

Wetland	Name	Key Biodiversity
		carruthersi and Serinus koliensis. There is suitable habitat for the globally threatened Chloropeta gracilirostris, but the species has yet to be recorded.
Lake Kyoga wetlands	Lake Opeta	The wetland of Lake Opeta has been considered to be of great importance for the conservation of birds, and there have been calls at the international level to afford this area a higher level of protection. It is the only permanent wetland in the Karamoja area. No detailed inventories have been conducted in this swamp, but from visits by NatureUganda staff it has been identified as important for the conservation of birds. Ploceus spekeoides has been recorded as breeding, but its overall status and distribution in Uganda remain poorly known. Species of the Lake Victoria Basin biome that are expected, but have not been recorded yet, include Bradypterus carpalis, Chloropeta gracilirostris, Cisticola carruthersi and Serinus koliensis. Non-bird biodiversity: The IBA borders Pian-Upe Wildlife Reserve, which is important for a number of mammal species of global conservation concern. The area was formerly renowned for its large numbers of large mammals, including Panthera leo (VU). Most of the surviving large mammals are in the south of the reserve, in the buffer zone between two Karamojong tribes, the Pian and the Pokot, along the Greek river which drains into Lake Opeta. The main watering grounds for the animals are the swamps associated with the lake.
Semliki wetlands incl. Lake Albert / George / Edward	Murchison Falls National Park	The Park boasts a rich avifauna, with a checklist of more than 460 species, due to its large size and wide range of habitats. It is certain that the list is incomplete and many additions can be expected with more intensive research. The convergence zone between the lake and the delta forms a shallow area that is important for waterbirds, especially Balaeniceps rex. This species is an important tourist attraction of MFNP, the only Park where one is almost certain of seeing the bird. Balaeniceps rex is regularly recorded along the Nile inside the park, especially at the delta and on two islands in the river. The globally near-threatened Phoenicopterus minor and Gallinago media have occasionally been recorded. Torgos tracheliotus occurs. The Park supports 20 species from three non-qualifying biomes: 11 species of the Guinea–Congo Forests, six species of the Afrotropical Highlands and three of the Somali–Masai biome. Non-bird biodiversity: The stretch of river between Murchison Falls and the delta has one of the biggest concentrations of Crocodylus niloticus in the world. Mammals of conservation concern include Loxodonta africana (EN; intensively studied), Giraffa camelopardalis (LR/cd; the largest population in

Wetland	Name	Key Biodiversity
		the country) and, formerly, both Diceros bicornis (CR) and Ceratotherium simum (CR). Both are now extinct in Uganda due to poaching, but reintroduction is being considered.
Semliki wetlands incl. Lake Albert / George / Edward	Semliki reserves	The species-richness is relatively high, with a list of 350 species for the Wildlife Reserve. The CHA has not been surveyed, but the mudflats at the shores of Lake Albert are worthy of particular investigation. The birds in the two reserves are mainly savanna-woodland species, with water-associated species along various streams through the reserves as well as at the shores of the lake. The tall vegetation along the marshy shores of the lake is home to Balaeniceps rex and other wetland birds, such as Microparra capensis and Nettapus auritus, whilst the papyrus swamp along the rivers holds Laniarius mufumbiri and perhaps other papyrus specialists.Although this site does not qualify for the Sudan–Guinea Savanna biome, it holds six species of this biome, including several that are at the extreme south of their range (but which are common in the Wildlife Reserve), such as Ptilostomus afer, Merops bulocki and Lamprotornis purpureus. Sixteen species of the Guinea–Congo Forests biome also occur in the Wildlife Reserve, as do four species of the Lake Victoria Basin biome. There is a single, unconfirmed report of the globally threatened Falco naumanni. Non-bird biodiversity: In the 1960s, the reserve was renowned for its high populations of Kobus kob (LR/cd) and Panthera leo (VU), but these were reduced to low levels through poaching during the period 1971–1986, as were Loxodonta africana (EN) and Alcelaphus buselaphus (LR/cd). An unknown number of chimpanzees Pan troglodytes (EN) occur in the reserve along the riverine forests.
Semliki wetlands incl. Lake Albert / George / Edward	Semliki National Park	Semliki Forest represents the only significant example of Congo-Basin vegetation in Uganda. A large number of species of the Guinea–Congo Forests biome reach their eastern limits here, in one of the richest localities for forest birds in Africa. The site contains half as many species of bird as the entire Congo and nearly two-thirds as many as in the 181,000 km² of the whole Upper Guinea Forests.No less than 70 species are only known within Uganda from Semliki Forest, including 31 of the Guinea–Congo Forests biome. Other species with very limited national ranges occur, such as Bycanistes fistulator (also recorded in Budongo Forest Reserve), Phyllanthus atripennis and Trochocercus nitens (also known from Mabira Forest Reserve), Ploceus aurantius (also common along the northern shores of Lake Victoria) and Malimbus erythrogaster (also recorded from Kibale National Park).Semliki forest is close to the Mount Rwenzori ranges, and the River Semliki meanders (forming oxbow lakes in some places) along the western border down to Lake Albert and is surrounded by swamp, where four species of the Lake Victoria Basin biome, including Laniarius mufumbiri and Cisticola carruthersi, occur. The site also has, surprisingly, six species of the Afrotropical Highlands biome, all widespread elsewhere in the country.

Wetland	Name	Key Biodiversity
		Non-bird biodiversity: Semliki Forest is outstandingly rich in wildlife—the area is believed to have been a forest refugium during the last arid period of the Pleistocene era, when conditions elsewhere on the continent were too dry to support forest vegetation. The park fauna is very rich and includes eight species of diurnal forest primate, as well as 51 species of forest swallowtail and Charaxes butterflies, including Papilio antimachus (DD). Milicia excelsa (LR/nt), Cordia millenii and Lovoa swynnertonii (EN) are forest trees considered endangered in the area. One species of primate and eight other mammals, as well as one butterfly, are only recorded from this area in East Africa. Threatened mammals include Loxodonta africana (EN) and Pan troglodytes (EN).
Semliki wetlands incl. Lake Albert / George / Edward	Virunga National Park	Species of interest known to occur include Prionops alberti, Bradypterus graueri and Cryptospiza shelleyi. Other species of global conservation concern that may be expected to occur are Indicator pumilio, Coracina graueri, Malaconotus lagdeni, Chloropeta gracilirostris, Eremomela turneri and Nectarinia rockefelleri. Nectarinia stuhlmanni is only known from the Rwenzori range. Phoenicopterus minor has been observed several times at Lake Edward and has once made an unsuccessful breeding attempt (c.1,000 birds in 1974). In addition, one species of the Eastern DR Congo lowlands EBA and one of the Sudan–Guinea Savanna biome have been recorded (see Tables 2 and 3). Non-bird biodiversity: 127>In total, 177 mammal species have been identified and it is estimated that the actual number may approach 200, making Virunga National Park one of the richest protected areas for mammals in the world. About half of DR Congo's mammal species occur in the park which covers about 0.3 % of the country's surface. The park is renowned for its population of the endangered Gorilla gorilla beringei (CR). Other species include Pan troglodytes schweinfurthii (EN), Cercopithecus l'hoesti rutshuricus (LR/nt), C. hamlyni (LR/nt), Panthera leo (VU), Loxodonta africana (EN), Okapia johnstoni (LR/nt) and Tragelaphus euryceros (LR/nt). The population density of Hippopotamus amphibius used to be among the highest known0.
Semliki wetlands incl. Lake Albert / George / Edward	Kibale National Park	So far, 339 species of birds have been recorded, but more species are likely to be added. Most research has been concentrated in a 10 km² area near Kanyawara and the rest of the park is only rarely visited. Among the scarcer species are Apaloderma vittatum, Campethera tullbergi, Trochocercus albiventris and Cryptospiza reichenovii, each found in only two other highland IBAs. There are old records of Francolinus nahani, but more recent surveys failed to find this endangered species. Non-bird biodiversity: The forest of this park lies close to the site of a postulated Pleistocene forest

Wetland	Name	Key Biodiversity
		refugium in the Albertine Rift area. This has resulted in a diverse community of forest species, which also includes many Congo-Basin species at the eastern limits of their ranges. Four important timber species are of conservation concern: Milicia excelsa (LR/nt), Cordia millenii, Entandrophragma angolense(VU) and Lovoa swynnertonii (EN). The park supports a rich fauna, including mammals of global conservation concern such as Loxodonta africana (EN), chimpanzee Pan troglodytes (EN), Procolobus badius and Cercopithecus l'hoesti (LR/nt), as well as the butterfly Papilio antimachus (DD).
Semliki wetlands incl. Lake Albert / George / Edward	Kyambura Wildlife Reserve	The fauna and flora are similar to that of Queen Elizabeth National Park (IBA UG007). Both IBAs have volcanic craters with saline lakes, which are important sites for waterbirds. A total of 332 bird species has been recorded in Kyambura Wildlife Reserve, including seven species of global conservation concern. Lake George, the Kazinga Channel and the seven crater-lakes within the reserve offer a large and varied habitat to many birds, including about 110 wetland species. Lakes Maseche, Nshenyi and Bagusa are within a few kilometres of each other, and the populations of Phoenicopterus minor in these craters can be considered as one. Since 1994, the number recorded on the three saline lakes together has exceeded 20,000 on several occasions, and reached 30,000 in February and August 1999. Although the population of Phoenicopterus minor in Uganda is only 2% of the total population in East Africa, these sites are of considerable conservation importance, since they represent alternative potential breeding sites if the traditional breeding sites are not available. Laniarius mufumbiri and Chloropeta gracilirostris were recorded in papyrus swamps along the shores of Lake George in November 2000. There is a roosting site for Pelecanus onocrotalus at Kashaka fishing village, with a single count of 900 birds in 1994. There are isolated records of Gallinago media and Hirundo atrocaerulea, and a 1994 record of Torgos tracheliotus by the Frontier-Uganda team. Non-bird biodiversity: Threatened mammals include Loxodonta africana (EN), Panthera leo (VU) and Pan troglodytes (EN).
Semliki wetlands incl. Lake Albert / George / Edward	Queen Elizabeth National Park and Lake George	This is one of the most popular National Parks in Uganda for birdwatchers. Its diversity is reflected in its list of more than 600 species, the highest number recorded in any IBA in Uganda and probably the highest of any protected area in Africa. Eleven species of global conservation concern have been recorded, and there are old records of three other such species, none of which has been seen recently: Crex crex, Hirundo atrocaerulea and Muscicapa lendu. Torgos tracheliotus is a breeding resident. Seven species of the Afrotropical Highlands biome have been recorded, as have three of the Sudan–Guinea Savanna biome. Other notable congregations at this site include Charadrius asiaticus at 'Shoebill Swamp' on Lake George. Munyanyange crater is an important site for a wide range of migrant waders,

Wetland	Name	Key Biodiversity
		including the highest national count for Recurvirostra avosetta (100) and notable numbers of Sterna nilotica, Larus fuscus and five species of duck. Since 1997, the Queen Elizabeth National Park Bird Observatory has operated from the park headquarters at Mweya, and by the end of 1999 had ringed over 4,000 birds of c.200 species. Non-bird biodiversity: Among threatened mammals, there are good populations of Loxodonta africana (EN) and Pan troglodytes (EN).
Lake Victoria wetlands	Lake Mburo National Park	The park has a diverse bird fauna, with over 310 species recorded. These include a number that have not been recorded in other parks in Uganda such as Ardeola rufiventris, Tricholaema melanocephala, Eremomela scotops, Euplectes orix and Cisticola fulvicapillus. Lybius rubrifacies, a restricted-range species, is occasionally seen, but is rare, probably reaching its northern limit here, and not known anywhere else in Uganda. The site is important for certain species of the Lake Victoria Basin biome, such as Bradypterus carpalis and Cisticola carruthersi, which are rare in other IBAs. The site has one Afrotropical Highlands biome species, Ploceus baglafecht. There are isolated records of two globally near-threatened species, Phoenicopterus minor and Gallinago media. Torgos tracheliotus occurs. Non-bird biodiversity: Lake Mburo is the only National Park in Uganda in which the ungulate Aepyceros melampus (LR/cd) is found.
Lake Victoria wetlands	Nabajjuzi Wetland	Nabajjuzi Wetland is important regionally and globally for conservation of vulnerable and threatened species of birds and other animals. The Shoebill (Balaeniceps rex) (Near-threatened) has been recorded in Nabajjuzi. Two papyrus endemic species have also been recorded in the wetland system, the Papyrus Gonolek (Laniarius mufumbiri) (near-threatened) and the Papyrus Yellow Warbler (Chloropeta gracilirostris) (Vulnerable). The Papyrus Yellow Warbler is a Lake Victoria Biome species. The wetland also supports the Grey Crowned Crane (Balearica regulorum) (CITES App. II) whose conservation status in Uganda is at stake because of the pressure on its breeding ground, the seasonal wetlands. Non-bird biodiversity: Nabajjuzi Wetland supports globally threatened bird species and the endangered Sitatunga. It is also important as a spawning ground for mudfish (Clarias mossambicus) and lungfish (Protopterus aethiopicus). The Sitatunga (Tragelaphus spekei) (CITES App. III), an antelope that inhabits wetlands, currently though not threatened is coming under increasing pressure due to threats on its habitat.

Wetland	Name	Key Biodiversity
Lake Victoria wetlands	Sango Bay area	About 300,000 Chlidonias leucopterus were reported by the Wetlands Inventory Team in 1994, but this has not been confirmed by later counts. Large numbers of Ardeola ralloides occur in the area. Pelecanus onocrotalus roost at the mouth of the River Kagera in several hundreds and small numbers of Pelecanus rufescens occur. A count of 82 Hirundo atrocaerulea was made in May 2001. Non-bird biodiversity: Plants of conservation interest include Pseudagrostistachys ugandensis, a grass not known elsewhere in Uganda, and Podocarpus usambaransis vardawei, an endemic variety. Loxodonta africana (EN) is the only globally threatened mammal species found in the area, but near-endemic mammals include Colobus guereza adolfi-friederici, which is restricted to Sango Bay in the Ugandan part of its range, and Cercopithecus mitis doggetti, which occurs at Sango Bay as part of a limited range in south-western Uganda.
Lake Victoria wetlands	Burigi - Biharamulo Game Reserves	The site is poorly known ornithologically. The only data available are from a 1995 waterbird count and occasional records from the woodland along the Biharamulo–Bukoba road which bisects the eastern part of the reserve. The varied habitat probably supports closer to 400 species than the 60 or so recorded so far. Balaeniceps rex is only known from four birds in 1995, but it is likely to be a regular visitor and possibly a breeding resident. Lybius rubrifacies is known from the periphery of the site and probably occurs in both reserves in reasonable numbers. Considerable areas of habitat suitable for Crex crex and Gallinago media, which are likely to occur on passage, exist. Five species of the Zambezian biome have been recorded (see Table 3)—some, such as Monticola angolensis and Myrmecocichla arnotti, reach their northern limits in this area. Non-bird biodiversity: There is a healthy population of plains game including Ourebia ourebi (LR/cd), an antelope that is relatively rare in much of northern and eastern Tanzania. Panthera leo (VU) occurs while Loxodonta africana (EN) were numerous as recently as 1975, but have suffered from poaching. The Brachystegia woodland provides habitat for the most northerly population of Hippotragus niger (LR/cd).
Lake Victoria wetlands	Mwanza Gulf	The only data available are from a 1995 waterbird survey. Numbers given are minima. The main roost-site south of Busisi held at least 15,000 birds. Numbers of Phalacrocorax carbo are likely to be seasonally higher than the 3,300 estimated and Phalacrocorax africanus probably exceeds the estimated 500 birds at certain times. No attempts have been made to survey the papyrus swamps and further work may reveal that species of the Lake Victoria Basin biome occur.

Wetland	Name	Key Biodiversity
Lake Victoria wetlands	Bunda Bay	A significant roost of Egretta garzetta occurs on Machuera and Namguma islands. More than 6,000 birds were counted in the area yet the total for the whole of Speke Gulf must be several times higher.
Lake Victoria wetlands	Nabugabo wetland	A complete species list for the birds of Nabugabo is not available yet, but over 180 species have been recorded. The scarce Serinus koliensis is among the species of the Lake Victoria Basin biome that are present. Two additional species of global conservation concern, Gallinago media and Circus macrourus, were recorded in December 2000 on seasonally flooded grassland. Hylia prasina and Alcedo quadribrachys occur in the forested areas close to the lake. Non-bird biodiversity: Nine species of indigenous fish of the family Cichlidae have been recorded from the lakes, including five endemic species of Haplochromis. The introduction of the non-native fish Oreochromis niloticus, O. leucosticus and Tilapia zillii in the 1950s and Lates niloticus in the early 1960s in both Lakes Victoria and Nabugabo has impacted negatively on the indigenous fish, which may now only remain in the satellite lakes.
Lake Victoria wetlands	Mabamba Bay	There has been no detailed inventory of the bay and its associated swamps, but one has now begun. However, a recent study of waterbirds of Lake Victoria revealed the presence of several species of conservation interest. This is the closest place to Kampala where Balaeniceps rex are regularly seen. The surrounding communities have reported breeding, and the young are sometimes collected by local people to be raised and eventually sold. This has not been very successful because of the specialized feeding habits of the birds, and as they grow they become expensive to feed. Balaeniceps rex feeds primarily on lungfish Protopterus aethiopicus, which is also prized by the local community. Balaeniceps rex is regularly recorded in pairs and threes in the marsh at Nakiwogo, c.2 km north-east of Mabamba Bay.Recent visits also confirmed the presence of flocks of other species, especially migrants such as Sterna nilotica, Chlidonias leucopterus and Chlidonias hybridus and residents such as Larus cirrocephalus. Other notable species found in the marsh include good numbers of Ardea goliath, Plectropterus gambensis and Nettapus auritus, and a number of migratory waders. The site may be important for Hirundo atrocaerulea, and there are old records of the globally near-threatened Circus macrourus. Non-bird biodiversity: Like many papyrus swamps adjacent to Lake Victoria, Mabamba contains the ungulate Tragelaphus spekii (LR/nt) which is commonly hunted by local people. More information on other fauna will become available after detailed studies of the area.

Wetland	Name	Key Biodiversity
Lake Victoria wetlands	Lutembe Bay	Although Chloropeta gracilirostris has been recorded only once, in papyrus along the bay, it is probably under-recorded in the Lake Victoria swamps. Laniarius mufumbiri is occasionally seen in papyrus, but its abundance is not known. Three additional species of global conservation concern have been recorded: occasional Balaeniceps rex, Rynchops flavirostris and one record of Ardeola idae.A comprehensive inventory of all bird species that occur in the bay is currently being made. Regular waterfowl counts since 1993 show a total of 108 waterbird species at the site, of which 26 are Palearctic migrants. The bay regularly supports 20,000–50,000 roosting waterbirds and, therefore, qualifies both as an IBA and for designation as a Ramsar Site. However, numbers shoot up to 100,000–200,000 and sometimes many more between October and February when there are Palearctic migrants. An estimate of 1,000,000 Chlidonias leucopterus was made in 1994, and counts in July 1999 show that between 500,000–1,500,000 birds roost on muddy islets when the water-level is low. Clearly Lutembe Bay is one of the most important migration stop-over sites in the Lake Victoria basin and a major roost-site for many species, including large congregations of migrant waders. Many Phalacrocorax carbo also feed and roost in the bay, the largest number recorded being 1,448 in July 1998. Non-bird biodiversity: Among mammals, the site supports Tragelaphus spekii (LR/nt) and Lutra maculicollis (VU).
Lake Victoria wetlands	Koguta swamp	Chloropeta gracilirostris has been recorded here (but appears to be uncommon), one of six Lake Victoria Basin biome species that are known to occur, including the papyrus endemics Laniarius mufumbiri (relatively abundant), Bradypterus carpalis and Cisticola carruthersi. Non-bird biodiversity: Little information is available. The ungulate Tragelaphus spekii (LR/nt) and the snake Python sebae occur, but their status is unknown. Like other wetlands around the shores of Lake Victoria, Koguta is probably an important refuge for a number of the lake's endemic haplochromine fish species.
Kagera wetlands	Kagera swamps	Little is known of the avifauna of the site. Chloropeta gracilirostris has been recorded from papyrus swamps along the Ruvubu river, which flows north into the Kagera river. There are no records from within the IBA site, but it is likely to occur. During the 1990s, up to 50 Balaeniceps rex were estimated to remain in the area although there has been only one record from the Tanzanian part of the swamps. Gallinago media has been recorded once from flooded grassland along the north-western shore of Lake Rushwa and it is likely that similar habitats in the IBA are seasonally important for this passage migrant. Laniarius mufumbiri has been recorded throughout the course of the Kagera river and along the

Wetland	Name	Key Biodiversity
		Ruvubu river to the south. Observations and ringing in 1987 and 1993 suggest it is not uncommon. It is unclear if Lybius rubrifacies, the distribution of which defines the 'Dry woodlands west of Lake Victoria' Secondary Area (s057), occurs at the site. There is little suitable habitat along the lake shore, but it is likely to occur in the hills overlooking the swamps. While only four species of the Lake Victoria Basin biome are known to occur at the site, it is possible that up to a further five may be present.
Kagera wetlands	Akagera National Park	At least 525 species are known from the park, reflecting the extremely wide diversity of habitat. These include 44 species of raptor, Balaeniceps rex and many Palearctic migrants, amongst which Falco naumanni, Gallinago media and Glareola nordmanni have been recorded. The park represents the northern limit of distribution of a number of Zambezian biome (A10) species, including Lanius souzae, Myrmecocichla arnotti and Cisticola angusticauda. In addition, one species of the Guinea–Congo Forests biome (A05) and seven of the Afrotropical Highlands biome (A07) also occur (see Table 3). However, all these data need to be reviewed in the light of the recent reduction in size of the park, which means that some species are no longer likely to occur within it, e.g. species of gallery forests (e.g. Camaroptera chloronota, Cossypha cyanocampter) and montane forests (e.g. Illadopsis pyrrhoptera, Cisticola chubbi). Non-bird biodiversity: More than 50 species of mammal are known from the park, including Lycaon pictus (EN), now thought to be locally extinct. Diceros bicornis (CR) and Loxodonta africana (EN) were introduced to the park in 1958 and 1975 respectively.
Kagera wetlands	Ruvubu National Park	More than 200 bird species have been recorded, including Ardeola idae, Circus macrourus, Falco naumanni and Gallinago media. Large numbers of waterbirds occur with counts of over 1,000 Pelecanus onocrotalus and large numbers of Mycteria ibis. Other species recorded include Neotis denhami. In addition, three species of the Guinea–Congo Forests biome and 10 of the Afrotropical Highlands biome have also been recorded (see Table 3). Non-bird biodiversity: Mammals of global conservation concern include Panthera leo (VU) and Tragelaphus spekii (LR/nt).
Kagera wetlands	Nyabarongo wetlands	Around 50 species have been recorded from the wetlands, including Ardeola idae and Circus macrourus. In addition, three species of the Afrotropical Highlands biome (A07) have been reported
Kagera wetlands	Akanyaru wetlands	At least 54 species of wetland habitats have been recorded from Akanyaru and include migrant Ardeola idae, Circus macrourus and Gallinago media. Falco naumanni has been reported. In addition, one

Wetland	Name	Key Biodiversity
		species of the Guinea–Congo Forests biome (A05) and three of the Afrotropical Highlands biome (A07) have been recorded (see Table 3). Non-bird biodiversity: The mammal Tragelaphus spekii (LR/nt) is known to occur.
Kagera wetlands	Rwihinda Lake Managed Nature Reserve	In the past, this site held large numbers of breeding Phalacrocorax carbo, Anhinga rufa, Egretta ardesiaca, Ardea melanocephala and Nycticorax nycticorax. Large numbers are rarely observed today, however, due to decreasing water-levels, fishing and agriculture. There are records of Ardeola idea, Circus macrourus, Falco naumanni and Gallinago media. In addition, one species of the Guinea–Congo Forests biome, five of the Afrotropical Highlands biome and two of the Zambezian biome have been recorded, while a third, Calamonastes undosus, used to do so, but is now possibly extinct locally due to habitat loss (see Table 3). Indeed, the current status of a number of species at Rwihinda is uncertain.
Mara	Mara Bay and Masirori swamp	Chlidonias leucopterus use the area in large numbers on a regular basis. In January 1995 a roost on Ryamugasire island, immediately to the east of Musoma town, contained a minimum of 3,500 Phalacrocorax carbo, 1,500 Phalacrocorax africanus and 924 Egretta garzetta. Some of these birds may have been included in counts of birds along a 5 km stretch of shoreline which revealed 500 Phalacrocorax carbo and 1,500 Phalacrocorax africanus. The islands at the entrance of the bay may provide significant roost and breeding sites for these species. Further work is required to refine the boundaries of the site, especially at Masirori swamp. A single Balaeniceps rex has been reported from this site and surveys are likely to reveal that species of the Lake Victoria Basin biome occur.
Sio Nzoia Yala Nyando wetlands	Kusa swamp	Kusa includes a substantial stand of papyrus, and the Near Threatened Laniarius mufumbiri is fairly abundant here. Other Lake Victoria Basin biome species include the papyrus endemics Bradypterus carpalis and Cisticola carruthersi, and it is suspected that Serinus koliensis and the globally threatened Chloropeta gracilirostris are likely to occur. Non-bird biodiversity: Little information is available. The ungulate Tragelaphus spekii (LR/nt) occurs but is uncommon, and the snake Python sebae has been recorded. Like other wetlands around the shores of Lake Victoria, Kusa is probably an important refuge for a number of the lake's endemic haplochromine fish species.
Sio Nzoia Yala Nyando wetlands	Dunga swamp	This is one of the most reliable sites in Kenya for the scarce and threatened Chloropeta gracilirostris, which is often seen along the lakeward side of the swamp. All but one of Kenya's nine Lake Victoria Basin biome species have been recorded here, and it is especially important for Laniarius mufumbiri (relatively common), Bradypterus carpalis and Serinus koliensis, all papyrus endemics.

Wetland	Name	Key Biodiversity
		Non-bird biodiversity: No information is available. Wetlands around the shores of Lake Victoria are known to be important refuges for a number of the lake's endemic haplochromine fish species. This is one of the most reliable sites in Kenya for the scarce and threatened Chloropeta gracilirostris, which is often seen along the lakeward side of the swamp. All but one of Kenya's nine Lake Victoria Basin biome species have been recorded here, and it is especially important for Laniarius mufumbiri (relatively common), Bradypterus carpalis and Serinus koliensis, all papyrus endemics. Non-bird biodiversity: No information is available. Wetlands around the shores of Lake Victoria are known to be important refuges for a number of the lake's endemic haplochromine fish species. This is one of the most reliable sites in Kenya for the scarce and threatened Chloropeta gracilirostris, which is often seen along the lakeward side of the swamp. All but one of Kenya's nine Lake Victoria Basin biome species have been recorded here, and it is especially important for Laniarius mufumbiri (relatively common), Bradypterus carpalis and Serinus koliensis, all papyrus endemics. Non-bird biodiversity: No information is available. Wetlands around the shores of Lake Victoria are known to be important refuges for a number of the lake's endemic haplochromine fish species.
Sio Nzoia Yala Nyando wetlands	Yala swamp complex	Yala swamp supports sizeable populations of Chloropeta gracilirostris (common in tall, undisturbed stands of fringing papyrus, especially at Lake Kanyaboli) and Laniarius mufumbiri. The Near Threatened Gallinago media, a Palearctic migrant, probably also occurs. Because of its size and the generally good condition of the papyrus, the Yala swamp complex is an important site for East Africa's papyrus endemics. These include Chloropeta gracilirostris, Cisticola carruthersi, Bradypterus carpalis and Serinus koliensis. Many other wetland birds also occur. Reports of occasional sightings of Balaeniceps rex by the local residents have not been confirmed. Regionally threatened species include Casmerodius albus (present in small numbers) and Porzana pusilla (recorded from Lake Kanyaboli, but may not be resident). Non-bird biodiversity: Lake Kanyaboli is an important refuge for Lake Victoria cichlid fish, many of which have been exterminated in the main lake by the introduction of the non-native predatory fish Lates niloticus. These include economically important species such as Oreochromis esculentus (VU), as well as a number of Haplochromis species. Lates niloticus is present in Lake Sare, which has an impoverished fish fauna compared to Kanyaboli.

Wetland	Name	Key Biodiversity
Sio Nzoia Yala Nyando wetlands	Sio Port swamp	This is an important site for Lake Victoria biome species, especially three papyrus endemics: Laniarius mufumbiri (relatively common), Bradypterus carpalis and Serinus koliensis. The globally threatened Chloropeta gracilirostris is not yet recorded but is likely to occur.
Sio Nzoia Yala Nyando wetlands	Busia grasslands	Hirundo atrocaerulea, a globally threatened intra-African migrant, is a non-breeding visitor to this area from April to September. It feeds over grassland and over 100 have been recorded roosting at the flooded grassland patch near Mungatsi. Gallinago media is an uncommon Palearctic migrant, likely to occur here regularly but its current status is uncertain. The riverine forest and scrub at Mungatsi also holds several Sudan–Guinea Savanna biome species that are not found in other IBAs. This is also the only Kenyan IBA in which Caprimulgus (pectoralis) nigriscapularis and Sylvietta virens, two Guinea–Congo Forests biome species, are recorded. Regionally threatened species include Circaetus cinerascens, Alcedo quadribrachys (recorded at Mungatsi) and Euplectes hartlaubi (nests in flooded grassland). Non-bird biodiversity: These vanishing grasslands have been little studied. On biogeographic grounds, they are likely to have close links with Ugandan grasslands and to contain species that are found nowhere else in Kenya.

Annex 8 – Wetland-dependent migratory bird species in relation to IBAs within chosen transboundary wetlands

Note: The data / information are replicated here from the combined BirdLife International and Wetland International website for the convenience of the reader, who is referred directly to their site for more complete and comprehensive coverage (http://criticalsites.wetlands.org/en).

Wetland	Name	Scientific name	English name	Season	Geometric Mean	Units	IBA criteria
Baro/Akobo Sobat Wetlands (Machar Marshes)	Baro River	Anastomus lamelligerus	African Openbill	winter	1000	individuals	A4i
Baro/Akobo Sobat Wetlands (Machar Marshes)	Baro River	Balaeniceps rex	Shoebill	resident		-	A1
Baro/Akobo Sobat Wetlands (Machar Marshes)	Baro River	Glareola nordmanni	Black-winged Pratincole	winter	500	individuals	A1
Baro/Akobo Sobat Wetlands (Machar Marshes)	Boma	Balaeniceps rex	Shoebill	resident		-	A1
Baro/Akobo Sobat Wetlands (Machar Marshes)	Gambella National Park	Balaeniceps rex	Shoebill	resident		-	A1
Dinder wetlands	Gezira	Anthropoides virgo	Demoiselle Crane	winter	1000	individuals	A4i
Dinder wetlands	Gezira	Chlidonias leucopterus	White-winged Tern	winter	4000	individuals	A4i
Kagera wetlands	Akagera National Park	Ardeola idae	Madagascar Pond-heron	winter		-	A1
Kagera wetlands	Akagera National Park	Balaeniceps rex	Shoebill	resident		-	A1
Lake Kyoga wetlands	Lake Bisina	Balaeniceps rex	Shoebill	resident		-	A1
Lake Kyoga wetlands	Lake Nakuwa	Balaeniceps rex	Shoebill	resident		-	A1
Lake Kyoga wetlands	Lake Opeta	Balaeniceps rex	Shoebill	resident		-	A1

Wetland	Name	Scientific name	English name	Season	Geometric Mean	Units	IBA criteria
Lake Tana wetlands	Bahir Dar Lake Tana	Bugeranus carunculatus	Wattled Crane	resident		-	A1
Lake Tana wetlands	Bahir Dar Lake Tana	Phoeniconaias minor	Lesser Flamingo	winter		-	A1
Lake Victoria wetlands	Bunda Bay	Egretta garzetta	Little Egret	winter	6056	individuals	A4i
Lake Victoria wetlands	Burigi - Biharamulo Game Reserves	Balaeniceps rex	Shoebill	resident		-	A1
Lake Victoria wetlands	Lake Mburo National Park	Balaeniceps rex	Shoebill	resident		-	A1
Lake Victoria wetlands	Lake Mburo National Park	Gallinago media	Great Snipe	winter		-	
Lake Victoria wetlands	Lake Mburo National Park	Phoeniconaias minor	Lesser Flamingo	winter		-	
Lake Victoria wetlands	Lutembe Bay	Chlidonias leucopterus	White-winged Tern	winter	866025.4	individuals	A4i
Lake Victoria wetlands	Lutembe Bay	Gelochelidon nilotica	Common Gull-billed Tern	winter		individuals	A4i
Lake Victoria wetlands	Lutembe Bay	Larus cirrocephalus	Grey-headed Gull	winter	12000	individuals	A4i
Lake Victoria wetlands	Mabamba Bay	Balaeniceps rex	Shoebill	resident		-	A1
Lake Victoria wetlands	Mwanza Gulf	Egretta garzetta	Little Egret	winter	5000	individuals	A4i
Lake Victoria wetlands	Nabugabo wetland	Balaeniceps rex	Shoebill	resident		-	A1
Lake Victoria wetlands	Sango Bay area	Chlidonias leucopterus	White-winged Tern	winter	100000	individuals	A4i
Nile Delta	El Malaha	Charadrius alexandrinus	Kentish Plover	winter	3290	individuals	A4i
Nile Delta	El Malaha	Larus genei	Slender-billed Gull	breeding	5700	breeding pairs	A4i

Wetland	Name	Scientific name	English name	Season	Geometric Mean	Units	IBA criteria
Nile Delta	El Malaha	Phalacrocorax carbo	Great Cormorant	winter	5300	individuals	A4i
Nile Delta	El Malaha	Phoenicopterus roseus	Greater Flamingo	breeding	433.01	breeding pairs	A4i
Nile Delta	El Malaha	Phoenicopterus roseus	Greater Flamingo	winter	6500	individuals	A4i
Nile Delta	El Malaha	Recurvirostra avosetta	Pied Avocet	winter	8910	individuals	A4i
Nile Delta	El Malaha	Spatula clypeata	Northern Shoveler	winter	8200	individuals	A4i
Nile Delta	Lake Burullus	Aythya nyroca	Ferruginous Duck	winter		-	A1
Nile Delta	Lake Burullus	Chlidonias hybrida	Whiskered Tern	winter	3530	individuals	A4i
Nile Delta	Lake Burullus	Glareola pratincola	Collared Pratincole	breeding	2000	breeding pairs	A4i
Nile Delta	Lake Burullus	Hydrocoloeus minutus	Little Gull	winter	3906	individuals	A4i
Nile Delta	Lake Burullus	Mareca penelope	Eurasian Wigeon	winter	24997	individuals	A4i
Nile Delta	Lake Burullus	Recurvirostra avosetta	Pied Avocet	winter	2949	individuals	A4i
Nile Delta	Lake Burullus	Spatula clypeata	Northern Shoveler	winter	15427	individuals	A4i
Nile Delta	Lake Burullus	Sternula albifrons	Little Tern	breeding	692.82	breeding pairs	A4i
Nile Delta	Lake Burullus	Tringa totanus	Common Redshank	winter	3378	individuals	A4i
Nile Delta	Lake Manzala	Ardea alba	Great White Egret	winter	528	individuals	A4i
Nile Delta	Lake Manzala	Ardeola ralloides	Squacco Heron	breeding	300	breeding pairs	A4i
Nile Delta	Lake Manzala	Charadrius alexandrinus	Kentish Plover	winter	4323	individuals	A4i
Nile Delta	Lake Manzala	Charadrius hiaticula	Common Ringed Plover	winter	563	individuals	
Nile Delta	Lake Manzala	Charadrius pecuarius	Kittlitz's Plover	winter	35	individuals	A4i
Nile Delta	Lake Manzala	Chlidonias hybrida	Whiskered Tern	winter	39331	individuals	A4i
Nile Delta	Lake Manzala	Crex crex	Corncrake	passage		-	A1
Nile Delta	Lake Manzala	Egretta garzetta	Little Egret	winter	1073	individuals	A4i
Nile Delta	Lake Manzala	Hydrocoloeus minutus	Little Gull	winter	47316	individuals	A4i
Nile Delta	Lake Manzala	Larus armenicus	Armenian Gull	winter	358	individuals	A4i
Nile Delta	Lake Manzala	Larus genei	Slender-billed Gull	winter	2269	individuals	A4i
Nile Delta	Lake Manzala	Larus ridibundus	Black-headed Gull	winter	45080	individuals	
Nile Delta	Lake Manzala	Phalacrocorax carbo	Great Cormorant	winter	22500	individuals	A4i
Nile Delta	Lake Manzala	Recurvirostra avosetta	Pied Avocet	winter	8981	individuals	A4i

Wetland	Name	Scientific name	English name	Season	Geometric Mean	Units	IBA criteria
Nile Delta	Lake Manzala	Spatula clypeata	Northern Shoveler	winter	12021	individuals	A4i
Nile Delta	Lake Manzala	Sternula albifrons	Little Tern	breeding	1500	breeding pairs	A4i
Nile Delta	Lake Manzala	Tringa totanus	Common Redshank	winter	3247	individuals	A4i
Nile Delta	Lake Manzala	Vanellus spinosus	Spur-winged Lapwing	breeding	300	breeding pairs	A4i
Nile Delta	Wadi El Natrun	Charadrius alexandrinus	Kentish Plover	winter	1120	individuals	A4i
Nile Delta	Wadi El Natrun	Charadrius pecuarius	Kittlitz's Plover	winter	45	individuals	A4i
Nile Delta	Wadi El Natrun	Charadrius pecuarius	Kittlitz's Plover	resident	70.71	breeding pairs	A4i
Nile Delta	Wadi El Natrun	Vanellus spinosus	Spur-winged Lapwing	breeding	150	breeding pairs	A4i
Semliki wetlands incl. Lake Albert / George / Edward	Kyambura Wildlife Reserve	Balaeniceps rex	Shoebill	resident		-	A1
Semliki wetlands incl. Lake Albert / George / Edward	Kyambura Wildlife Reserve	Gallinago media	Great Snipe	winter		-	
Semliki wetlands incl. Lake Albert / George / Edward	Kyambura Wildlife Reserve	Himantopus himantopus	Black-winged Stilt	non-breeding	4100	individuals	A4i
Semliki wetlands incl. Lake Albert / George / Edward	Kyambura Wildlife Reserve	Phoeniconaias minor	Lesser Flamingo	non-breeding	30000	individuals	A1, A4i
Semliki wetlands incl. Lake Albert / George / Edward	Murchison Falls National Park	Balaeniceps rex	Shoebill	resident		-	A1
Semliki wetlands incl. Lake Albert / George / Edward	Murchison Falls National Park	Glareola nordmanni	Black-winged Pratincole	winter		-	A1
Semliki wetlands incl. Lake Albert / George / Edward	Murchison Falls National Park	Glareola nuchalis	Rock Pratincole	non-breeding	707.11	individuals	A4i

Wetland	Name	Scientific name	English name	Season	Geometric Mean	Units	IBA criteria
Semliki wetlands incl. Lake Albert / George / Edward	Murchison Falls National Park	Rynchops flavirostris	African Skimmer	non-breeding	1400	individuals	A1, A4i
Semliki wetlands incl. Lake Albert / George / Edward	Queen Elizabeth National Park and Lake George	Ardeola idae	Madagascar Pond-heron	winter		-	A1
Semliki wetlands incl. Lake Albert / George / Edward	Queen Elizabeth National Park and Lake George	Balaeniceps rex	Shoebill	resident		-	A1
Semliki wetlands incl. Lake Albert / George / Edward	Queen Elizabeth National Park and Lake George	Gallinago media	Great Snipe	winter		-	A1
Semliki wetlands incl. Lake Albert / George / Edward	Queen Elizabeth National Park and Lake George	Gelochelidon nilotica	Common Gull-billed Tern	non-breeding	1200	individuals	A4i
Semliki wetlands incl. Lake Albert / George / Edward	Queen Elizabeth National Park and Lake George	Glareola nordmanni	Black-winged Pratincole	winter		-	A1
Semliki wetlands incl. Lake Albert / George / Edward	Queen Elizabeth National Park and Lake George	Pelecanus onocrotalus	Great White Pelican	non-breeding	1800	individuals	A4i
Semliki wetlands incl. Lake Albert / George / Edward	Queen Elizabeth National Park and Lake George	Phoeniconaias minor	Lesser Flamingo	winter		-	A1
Semliki wetlands incl. Lake Albert / George / Edward	Semliki reserves	Rynchops flavirostris	African Skimmer	non-breeding	650	individuals	A1, A4i
Semliki wetlands incl. Lake Albert / George / Edward	Semliki reserves	Balaeniceps rex	Shoebill	resident		-	A1

Wetland	Name	Scientific name	English name	Season	Geometric Mean	Units	IBA criteria
Semliki wetlands incl. Lake Albert / George / Edward	Virunga National Park	Balaeniceps rex	Shoebill	resident		-	A1
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Anastomus lamelligerus	African Openbill	winter	344487	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Ardea alba	Great White Egret	winter	19074	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Ardea purpurea	Purple Heron	winter	5049	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Ardeola ralloides	Squacco Heron	winter	18414	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Balaeniceps rex	Shoebill	winter	6407	individuals	A1, A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Balaeniceps rex	Shoebill	resident		-	A1
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Balearica pavonina	Black Crowned-crane	winter	36823	individuals	A1, A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Bubulcus ibis	Cattle Egret	winter	172359	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Ciconia ciconia	White Stork	winter	16500	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Ciconia microscelis	African Woollyneck	winter	2475	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Dendrocygna bicolor	Fulvous Whistling-duck	winter	8775	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Dendrocygna viduata	White-faced Whistling-duck	winter	51810	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Leptoptilos crumenifer	Marabou	winter	359719	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Mycteria ibis	Yellow-billed Stork	winter	11154	individuals	A4i

Wetland	Name	Scientific name	English name	Season	Geometric Mean	Units	IBA criteria
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Pelecanus onocrotalus	Great White Pelican	winter	5643	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Pelecanus rufescens	Pink-backed Pelican	winter	11187	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Plectropterus gambensis	Spur-winged Goose	winter	150216	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Plegadis falcinellus	Glossy Ibis	winter	1695240	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Sarkidiornis melanotos	African Comb Duck	winter	9611	individuals	A4i
Sudd (Bahr el Jebel)	Sudd (Bahr-el-Jebel system)	Threskiornis aethiopicus	African Sacred Ibis	winter	17688	individuals	A4i

Annex 9 – Informational and pictorial summaries of examples of typical wetland types

The following informational and pictorial summaries represent a stylised overview of generic wetland types, represented by examples, within the basin. Typical marsh / floodplain wetlands are represented by the Sudd, fringe wetlands associated with deep water lakes are represented by Sio Siteko and confined rivers with seasonal floodplains by the Dinder floodplains.

MARSHES AND FLOODPLAINS e.g. Sudd:

695 Species; 44 Threatened; 32 Flagship; 15 Umbrella; 22 Endemic;
Wetland Integrity of 87%; High ranking for role in bird, antelope & fish migration

HYDROLOGY

The two major components that drive wetland dynamics are the dry season base flows and wet season floods. Base flows maintain stream perenniality, open water habitats and permanent marsh areas (fringe vegetation and Papyrus. Floods maintain lateral and longitudinal connectivity, recharge pools and backwater areas, flush out floating aliens and most importantly flood the floodplain. To function best, floodplain require about 3 months of flooding between June and October.

HABITATS

Grassland Floodplain
Two types: wild rice grassland dominated by Oryza longistaminata and Echinochloa grassland dominated by E. pyramidalis.

Reeds
A zone beyond the Papyrus dominated by Phragmites karka (reeds). Oryza barthii also present

Open Water
With or without floating Papyrus; rooted aquatic species include water Lily (Nymphae lotus), Potamogeton, Trapa and Ceratophyllum

Active Channel
May support some aquatic plant species

Permanent Marsh
Fringe Vegetation characterised by bands of Vossia cuspidata or Echinochloa stagnina, followed by notable zones of Papyrus (Cyperus papyrus) and Typha domingensis.

SOME FLAGSHIP SPECIES

Nile Lechwe
Endangered antelope found in marsh and grasslands, typically in shallow waters bordering deeper swamps, competes with livestock but hunted as food

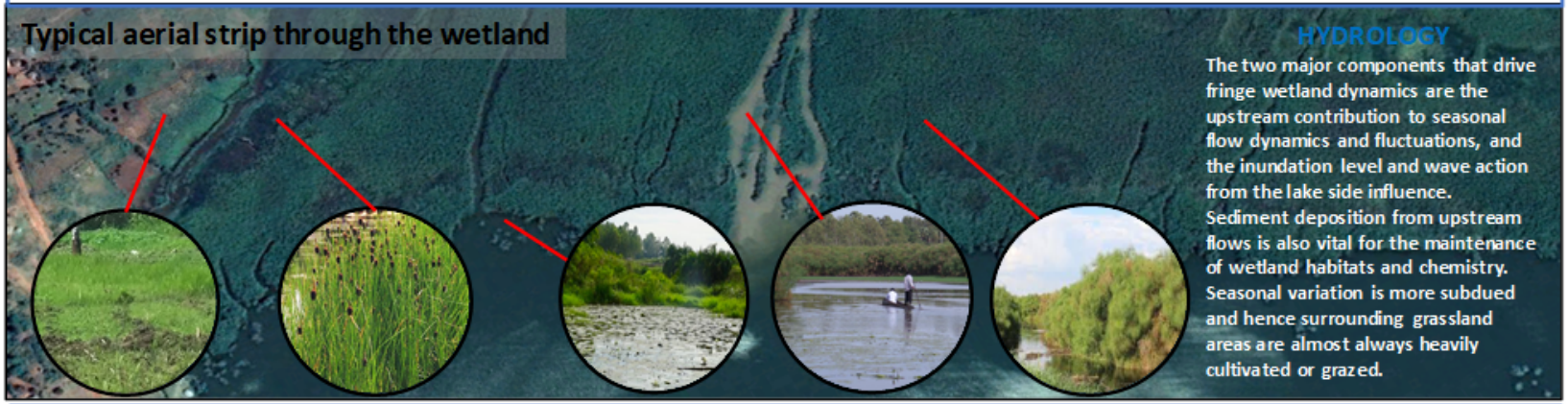
Vundu Catfish
Potamodromous, limnophilic, requires slow open water and permanent marsh, good source of protein for people

Shoebill
Vulnerable, non-migratory, occurs in extensive, dense freshwater marshes, valuable for ecotourism

White Eared Kob
Inhabit flat areas and open country close to permanent water, drinks daily and dependent on floodplain for grazing, as are livestock. Reduced flooding will also reduce grasslands

FRINGE WETLANDS AROUND LAKES e.g. Sio Siteko: 980 Species; 117 Threatened; 22 Flagship; 12 Umbrella; 203 Endemic;

Wetland Integrity of 40%; Moderate role in bird migration, but critical for fish nursery sites



HYDROLOGY

The two major components that drive fringe wetland dynamics are the upstream contribution to seasonal flow dynamics and fluctuations, and the inundation level and wave action from the lake side influence. Sediment deposition from upstream flows is also vital for the maintenance of wetland habitats and chemistry. Seasonal variation is more subdued and hence surrounding grassland areas are almost always heavily cultivated or grazed.

HABITATS

Grassland Floodplain
Mostly dominated by wild rice grassland (Oryza longistaminata) but transformation is common and extreme, mostly cultivation.

Reeds or Typha
A zone beyond the Papyrus dominated by Phragmites karka (reeds) & *Typha* species (rushes).

Open Water at Lake Edge
Rooted aquatic species include water Lily (Nymphae lotus), Potamogeton, Trapa and Ceratophyllum, critical ecotones between wetland & lake

Active Channel
May support some aquatic plant species, overhanging vegetation important for fish

Permanent Marsh
Fringe Vegetation characterised by bands of Vossia cuspidata or Echinochloa stagnina, followed by notable zones of Papyrus (Cyperus papyrus) and Typha domingensis.

SOME FLAGSHIP SPECIES

Nile Lechwe
Endangered antelope found in marsh and grasslands, typically in shallow waters bordering deeper swamps, competes with livestock but hunted as food

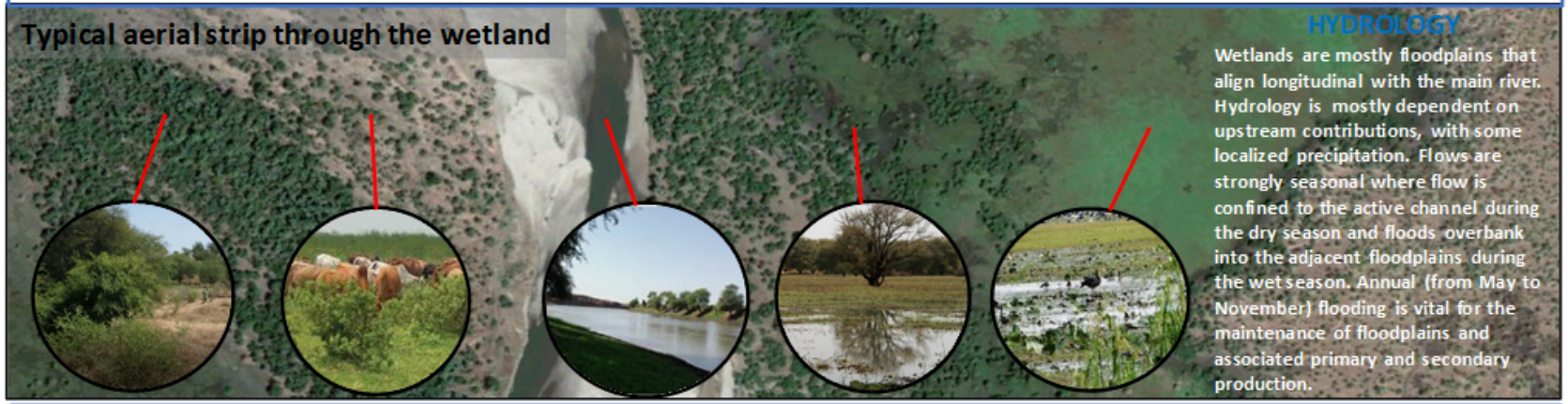
Papyrus Gonolek
Papyrus endemic, occurs in extensive, dense freshwater marshes, valuable for ecotourism

Cichlids
Many endemic & endangered species, wetlands provide refugia and nursery sites and support fish production in wetlands and lake

Giant Bullfrog
Inhabit marshes and fringes, up to 25 years to mature, important in overall food chain, protected species in some countries, threatened by habitat loss & harvesting as a food source

CHANNELED WETLANDS ALONG RIVERS e.g. Dinder Floodplain:

592 Species; 42 Threatened; 27 Flagship; 11 Umbrella; 11 Endemic; Wetland Integrity of 50%; Moderate role in bird migration



HYDROLOGY

Wetlands are mostly floodplains that align longitudinal with the main river. Hydrology is mostly dependent on upstream contributions, with some localized precipitation. Flows are strongly seasonal where flow is confined to the active channel during the dry season and floods overbank into the adjacent floodplains during the wet season. Annual (from May to November) flooding is vital for the maintenance of floodplains and associated primary and secondary production.

HABITATS

Riparian Thicket
Dense trees & shrubs, important for browsers and nesting birds. Source of firewood & building material, dependent of flow in channel

Sand Bars
Alluvial deposition at various stages, colonised by shrubs, small trees and grasses, extensive grazing.

Active Channel
Confined, does not support vegetation, a refugia for aquatic fauna and a water source.

Maya Wetlands
Maya wetlands are back swamps formed by river meandering and erosional and depositional processes.

Grassland Floodplain
Mostly dominated by wild rice grassland (Oryza longistaminata) and a vital source of grazing for livestock and wildlife.

SOME FLAGSHIP SPECIES

Nile Softshell Turtle
Vulnerable, fresh-water and brackish habitats, the only species of the genus Trionyx that isn't extinct, hunted for food and for shells.

Black Crowned Crane
Vulnerable, uses floodplains for nesting, valuable for ecotourism

Black Rhino
Critically Endangered, potential for ecotourism, inhabits dense thorny thickets along rivers & around wetlands

Nile Crocodile
Requires permanent water, inhabits wetlands and riparian zones, requires alluvial sediment deposits for nesting, competes with humans but is hunted for food and hides.

ONE RIVER
ONE PEOPLE
ONE VISION

Nile Basin Initiative Secretariat
P.O. Box 192
Entebbe – Uganda
Tel: +256 414 321 424
+256 414 321 329
+256 417 705 000
Fax: +256 414 320 971
Email: nbisec@nilebasin.org
Website: http://www.nilebasin.org

/Nile Basin Initiative
@nbiweb

Eastern Nile Technical Regional Office
Dessie Road
P.O. Box 27173-1000
Addis Ababa – Ethiopia
Tel: +251 116 461 130/32
Fax: +251 116 459 407
Email: entro@nilebasin.org
Website: http://ensap.nilebasin.org

ENTRO

Nile Equatorial Lakes Subsidiary Action Program Coordination Unit
Kigali City Tower
KCT, KN 2 St, Kigali
P.O. Box 6759, Kigali Rwanda
Tel: +250 788 307 334
Fax: +250 252 580 100
Email: nelsapcu@nilebasin.org
Website: http://nelsap.nilebasin.org

NELSAP-CU